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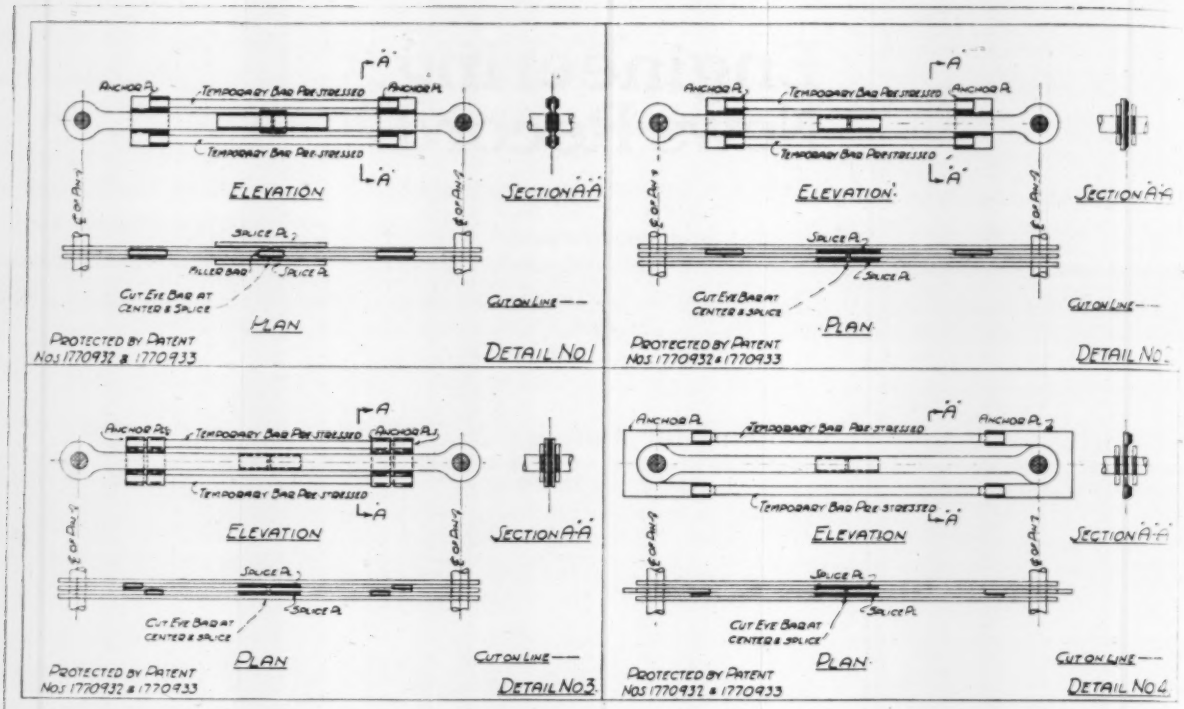

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Construction United in Purpose

A NEW milepost in the annals of construction was erected by the highway and building congress held at Detroit last week. The gathering, first of its kind, was memorable also as the construction industry's response to the call of the times for unity, vision and action. The congress answered this call with a record of substantial achievement.

Unity of purpose was attained. The twenty-odd construction groups represented at the congress coalesced into a united industry ready for its part in the work of reconstruction. The first step was taken toward developing that broader planning by which construction may hope to appraise the need for its service and so shape its own activities as to perform that service adequately and efficiently.

A CONGRESS of construction would have been significant in any past era, but truly great expectations were justified in the present instance by the epochal character of events. A brief indication of these expectations was given in our leading editorial of three weeks ago. We then said that, if the construction industry is to fit itself for the development of a constructive program and plan as the necessary basis of stabilization, it must attain the strength of unity both in thought and in action. The scattered groups of the construction field have been unable separately to make headway in this direction. It was hoped that the result might be accomplished through the Detroit congress. And of even higher value and more immediate importance was the new spirit of courage that the Congress could bring into being—revived faith in the enterprise which built this nation to its commanding stature.

In large part these hopes were realized. The spirit of mutual understanding which brought the separate groups together also induced them to subordinate their individual interests to the larger common objective. They realized that construction employment is the principal weapon for fighting unemployment, and that this weapon must be made effective through harmony of effort. Engineers, constructors, manufacturers and public officials found themselves united in this spirit. Under its impetus the congress made a beginning toward organized action, weak and imperfect as yet, but representing a substantial advance.

THIS achievement of the highway and building congress outweighs the technical work of its numerous sessions. Even the latter was notably broad and important, in such degree as to claim much of the space of the present issue. It was notable particularly because of the emphasis given to planning, as discussed in another column. The accomplishment of unity, however, was the dominant characteristic of the congress.

It remains to consolidate the advance by concrete planning and action. But in this task the construction industry does not stand alone; it claims the support of the entire business world. Because of its intimate commercial and economic relationship to general business and to every form of productive industry, construction enlists their support and aid. Alone it can accomplish little; with all of industry and business to reinforce its effort its labors can be of powerful effect.

CONSTRUCTION so aided can bring about the reeducation of the people to its opportunities and responsibilities. It can transform the still prevailing deflation attitude into a constructive spirit of rebuilding. It can, and we believe it will, lead on to a new future of greater power and better performance.——THE EDITORS.

Boston-Worcester Turnpike Paved by Truck Mixers

Two years' experience and improvement on three large contracts develop a train of equipment and processes producing concrete pavement at exceptional speed

IN CONSTRUCTING the new four- and six-lane road from Boston to Worcester, Mass., opportunity was given the contractor for three successive sections in 1931 and 1932, working with the equipment manufacturers, to develop truck-mixer paving plant to a high degree of efficiency. This development, with incidental facts of other construction methods, is outlined in the following account of the second contract of 1931 and the contract of 1932.

The road

The new road between Boston and Worcester is a reconstruction and replacement of the old turnpike, shortened and straightened by departures to new locations, widened to four, five and six paved ways, provided with wide shoulders, concrete bridges and safety intersections and generally characterized by all the design and structural excellences of the modern superhighway. To these structural features the planning had added an element of engineering inquiry.

A dual-type (bituminous and concrete) oversurfacing has been used on a part of the road, on a part the two sets of traffic lanes are separated by a parkway, a part of the road has been paved with two-course concrete having a cloth diaphragm between courses, both truck-mixer and standard paving-mixer concrete have been used, and differences have been introduced in edge and curb construction. This variety of structure and construction affords a comparison of experience without depreciating the road as a serviceable improvement.

The new road is 45 miles long. It has four and six traffic lanes separated into right and left two-lane or three-lane roadways generally by a curb-inclosed parkway but in some sections by a center lane of bituminous construction. The pavement is concrete. A typical four-lane section, with parkway, is shown by Fig. 1. Considering a transverse profile, the road consists of a 7-ft. oiled gravel shoulder, a 3-ft. bituminous macadam edge, two or three lanes of concrete, a parkway strip, two or three lanes of concrete, a 3-ft. bituminous macadam edge and a 7-ft. gravel shoulder. The total width between outside edges of shoulders is then 70 ft. for four-lane and 90 ft. for six-lane road.

In the earlier construction the parkway strip was 10 ft. wide, with the inner-lane slabs butting close against the parkway curb. Experience with the construction indicated that a wider inner lane was desirable in keeping passing vehicles off the curb, so that the parkway was narrowed to 8 ft., and the extra 1-ft. spaces between inner-slab edges and the curbs were paved with asphaltic concrete, as shown by Fig. 2. Later a change was made from a vertical to a battered curb.

Fig. 1—Four-lane section of new Boston-Worcester turnpike with curbed parkway separating the two pairs of lanes; the concrete has a 3-ft. bituminous macadam edge and a 7-ft. oiled gravel shoulder on each side; the four traffic lanes and parkway are 50 ft. wide.

Fig. 2—The concrete lane next to parkway was widened on part of the road by 1-ft. strips of asphaltic concrete, and the width of the parkway was reduced to 8 ft.

Bridges and intersections were the major structures of importance aside from the roadway. They call for mention only as being of the most modern types of concrete design and construction. Intersecting traffic lanes were separated with cloverleaf or other designs of interchange ramps where required. A typical overhead crossing is shown by Fig. 3.

The trial method

The road work was divided into a number of contracts extending over 1930, 1931 and 1932. In two of the 1931 contracts the contractor proposed truck-mixed concrete, and the state highway engineers laid down requirements for its use. These were largely requirements for very close inspection control of the quality of mixture and of methods of distribution that would prevent segregation. The thought was not to throw obstacles in the way of the new mixing

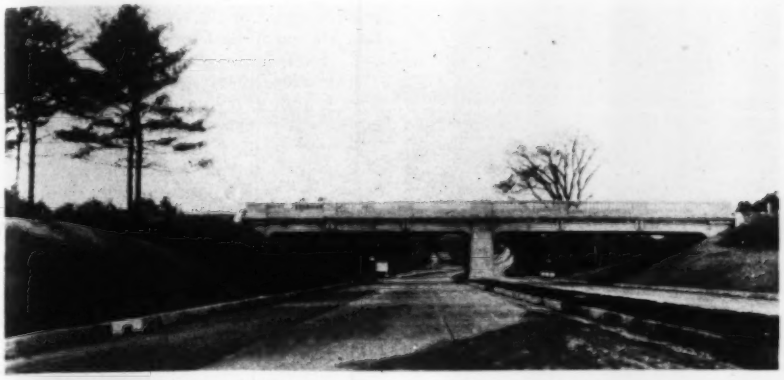


Fig. 3—Attractive concrete bridges separate the grades of intersecting roads and of the Boston-Worcester turnpike; where necessary, cloverleaf and other style ramps enable traffic interchange at intersections.

and placing methods, but, as they were largely untried methods on state road work, to give them close scrutiny and direction to insure standard pavement quality.

Considering the second contract as being naturally the better organized of the 1931 truck-mixer contracts, the plant and operations included aggregate preparation and batching, truck-mixing and slab construction. To aid in orienting the two 1931 contracts and that of 1932, it is noted that the road runs slightly south of west from Boston to Worcester, with Framingham about midway between. The second contract being described extended west 5 miles from Framingham, and the first contract was just west of the second. The third, or 1932, contract, extends east from Framingham for 5.7 miles.

The location of the aggregate and batching plant was determined by a sand and gravel deposit near the line of the road and about 1½ miles west of the east or Framingham end of the 5-mile contract. The plant was of ordinary character: A power shovel loaded the pit material into trucks, which dumped onto a grizzly from which the oversize stone went to a crusher. The passing material was washed and screened, and the sand and gravel, with the crushed stone, were belt-conveyed separately to a two-compartment elevated bin (Fig. 4) with weighing hoppers for batching.

A feature of the aggregate batching was that the water in the washed coarse aggregate and in the inundated-sand was depended upon for the water content of the concrete. Mixer-tank water was not used in the concrete but only for washing out the mixer on its return trip, being admitted when the mixer truck had discharged its concrete at the slab and emptied out at the batching plant just before the fresh batch was charged.

With the aggregate charge, the truck-mixer moved to the cement storage, where it received its cement from a hopper in an elevated platform. The completed charge for a 3½-cu.yd. batch was 3,634 lb. of sand, 8,070 lb. of coarse aggregate, 23 bags of cement and from 520 to 600 lb. of water.

Fig. 4—Aggregate batching bins loaded by inclined belt conveyor on 1931 truck-mixer operation; truck mixer is moving under bins to receive 3½-yd. batch; all batching was by weight.

The mixing was done in transit in fourteen standard-make 3½-cu.yd. truck-mixers with rear-end discharge. A minimum mixing time of 5 min. was set, and it was also required that no batch should be in the truck more than one hour between charging and discharging. The usual control testing and inspections exercised in all the state concrete road work were also carried out. Discharging the truck mixers and distributing the concrete were the main problems.

The tail discharge of the truck-mixer traveling parallel to and outside the slab forms required the concrete to be conveyed laterally to between the forms. At the lowest discharge elevation of the down-tilting mixer drum the ordinary gravity chute had too flat a slope to carry the concrete beyond the nearest inside quarter of the slab width. This piling of the concrete on one side required an uneconomical amount of shovel-spreading by the contractor and presented the hazard of segregation to the engineers. A better means of distribution had to be provided.

After various trial devices a belt conveyor swung on a boom carried by a carriage riding astride the slab to be concreted was decided upon. The device is indicated by Fig. 5. In operation as shown, the belt boom was swung around, on the end wheel shown, under the discharge chute of the mixer; when the batch was discharged the boom was swung back out of the way of the incoming truck-mixer. The carriage was a four-wheel affair riding on the forms like a finishing machine and propelled by a gasoline engine. A separate engine on the carriage operated the belt conveyor.

This device deposited the concrete midway between the forms, conveyor and truck-mixer being moved ahead to form a windrow of the proper volume, which was spread by shoveling. A 3½-yd. batch was discharged in 1 to 1½ min. The average performance was 500 cu.yd. in ten hours, or about 2,000 ft. of 10-ft. slab. Finishing, curing and joint construction followed the usual procedures. Curing was considered complete when a 6x6x30-in. beam showed a modulus of rupture of 500 lb. Fig. 6 shows the sprinkling truck used in curing, and Fig. 7 shows the truck used for setting granite curbing.

The improvements

The 1932 contract was for 5.7 miles of six-lane concrete paving to be separated, three lanes on a side, by a parkway. Bids were asked on single-course pavement and two-course pave-

Fig. 5—Discharge from truck-mixer in 1931 operation was distributed by traveling belt conveyor in a windrow midway between slab forms; conveyor on the swinging boom could be swung clear of path of incoming truck-mixers; note rear-end mixer discharge.

Fig. 6—Subgrade was dampened and curing slab was kept wet by sprinkling truck with a swinging sprinkler having a 10-ft. reach on each side of the truck.

ment with a cloth separator between courses. The prices of the successful bidder were lower for the two-course pavement, and it was built. It consisted of a 7-in. base course of 1:2½:5 concrete of ¼- to 2½-in. stone, a layer of jute fabric and a 2-in. top course of 1:1½:2 concrete of ¼- to ⅜-in. stone. The theory of this construction is that the top wearing course can be removed when necessary for repairs and resurfacing.

With the truck-mixer equipment experience of his 1931 contracts to draw upon, the contractor worked out the following major improvements: (1) use of larger truck-mixers of 5-cu.yd. capacity with discharge from the side of the truck instead of over the tail; (2) use of bulk cement shipped by rail in 25-bbl. bottom-dump steel containers; (3) distribution of the truck-mixer discharge evenly across the slab by a new form of spreader. Incidentally a device operated by the spreader for the top course was developed for laying the fabric diaphragm. Also, the slab was cured by covering with paper.

Taking up the different plant elements in order, the equipment for producing sand and coarse aggregate was substantially the same as that employed in 1931. This plant, however, deposited the screened and washed material into two groups of stockpiles within crawler crane reach of two sets of elevated batching bins, one of which is shown by Fig. 8. Duplicate bins were used to permit the aggregates to dry out by loading from alternate groups of stockpiles, changing every 24 hours. The bins were of standard weighing-batcher makes.

The handling of the cement was completely mechanized. The cement was loaded at the mill into 25-bbl. steel-box containers and shipped twelve containers on a flatcar to the work. Fig. 9

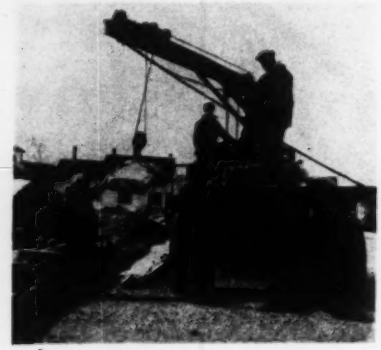


Fig. 7—Motor-truck crane transported and placed granite slabs for parkway curbs.

shows these containers being unloaded into a trackside hopper, from which it was conveyed by pumping to the batching bin. The batching was by weight. Principal interest in the batching plant, however, lies in the aggregate bin arrangement, so that the truck-mixer travel was directly through, without backing or short turns, and in the time analysis and check of operations that produced a regular batching-time cycle of 2½ min. for a 5-yd. batch.

For paving work the truck-mixers were a new development both in respect to the overside discharge and the 5-cu.yd. batch capacity. Ten truck-mixers were installed, determined by a planned progress schedule as follows: A total of 51,000 cu.yd. of concrete, or 3,500 ft. of 10-ft. two-course slab a day, for 51 days, was scheduled with a maximum haul of 6.8 miles, 6 miles of which was over the completed slab. The mixer drums were operated by separate 45-hp. engines and were reversible end to end or in direction of rotation with only easy job changes. The total weight loaded was 20 tons, and the traveling speed was 27 miles an hour. The discharge time with full opening was 2 min.

Distribution had to be arranged for two courses of different mixtures. This required part of the trucks, about one in four, to carry surface material, and the use of duplicate distributing machines. These were carriages riding on the forms and carrying side hoppers into which the truck-mixers discharged. The operation was as follows: From the hopper a belt conveyor ran to a deflector plate about midway between forms. This deflector plate shunted the concrete two ways to a right and left screw conveyor extending across the slab and distributing full width. Behind the conveyor the carriage carried a strike-off and behind this a tamping bar, which roughly evened the surface. This was the complete operation for the base course. Fig. 10 shows a truck-mixer and spreader in operation.

For the surface course the machine and operation were the same, except that the spreader pushed ahead of it a carriage carrying a spool and riller for laying the dividing fabric as shown by Fig. 11. A standard finishing ma-

Fig. 8—One of duplicate aggregate-batching bins for 1932 operation; bins were loaded by cranes from two sets of stockpiles used on alternate days to permit drainage of washed aggregate.

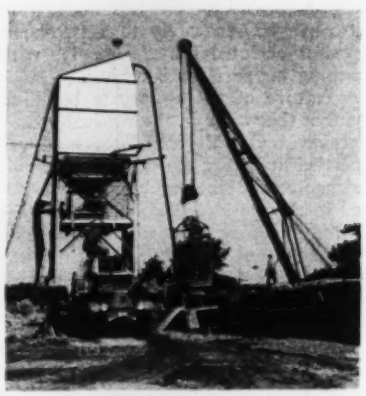


Fig. 9—Cement was delivered by rail, twelve 25-bbl. containers per car, and dumped by crane in a track-side hopper and thence pumped into elevated batching bin.

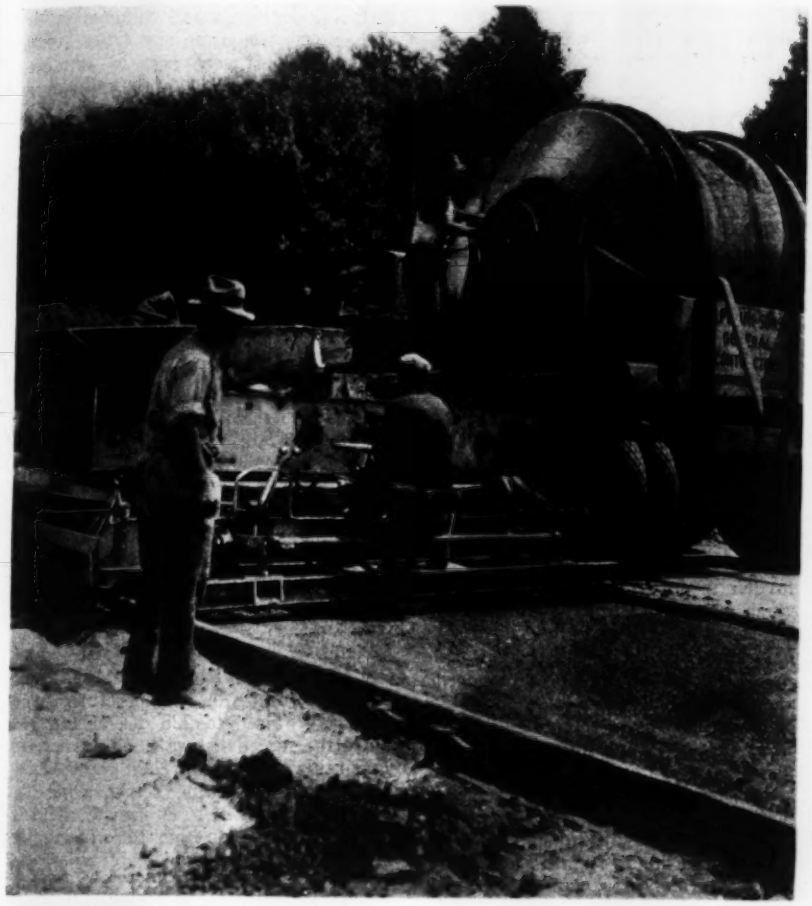


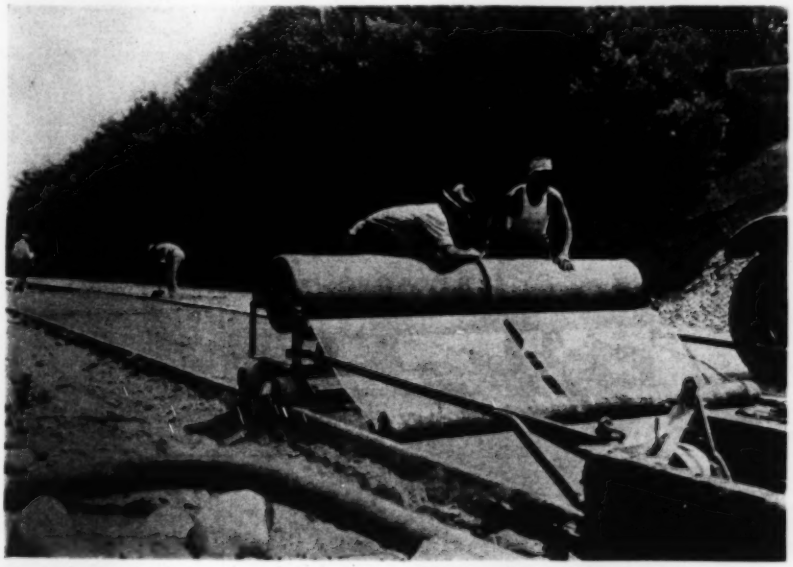
Fig. 10—Overside-discharge truck-mixers in 1932 operation feed directly to spreader, which distributes concrete in even layer between forms, strikes off the surface and tamps the slab.

chine completed the surface course following directly behind the spreader.

The spreaders were made to operate at two speeds forward 9 to 15 ft. and 20 to 40 ft. a minute, with a speed of 100 ft. in reverse. The slower speed was required on the thick base slab. In average operation the machines placed 2,700 ft. of slab a day. On occasions a mile of slab was laid in a day. Curing was done with burlap for 24 hours and then heavy kraft paper.

The two-course paving required a variation in joint construction. Transverse joints were located every 57 ft. and filled with a premolded asphalt strip. On account of striking off the base concrete 2 in. below the tops of the forms, it was necessary, before concreting, to depress the premolded strip of joint material in a groove excavated 2½ in. deep across the subgrade to provide clearance above it for the passage of the spreading machine. After the top-course concrete had been placed, the premolded joint strip was pulled up to within 1 in. of the finished paver surface by hooks applied at each end. The 1-in. depth at the top was later filled with asphalt.

Fig. 11—Cloth-laying device for two-course slab; this device pushed ahead of spreader for surface course and spread cloth smoothly on the top surface of the base course.



The direction

The construction described was carried out by the Massachusetts Department of Public Works, A. W. Dean, chief engineer, and F. D. Sabin, district engineer. The contractors were B. Perini & Sons, Inc., Framingham, Mass.

Improved Asphalt Emulsion

A new method of manufacturing asphalt emulsions, devised in the chemical engineering laboratories of Columbia University, New York City, according to a report to the American Chemical Society by Prof. A. W. Hixson and J. M. Fain, has produced an emulsion possessing the desirable properties of both hot asphalt and emulsified asphalt. In addition, the ease of producing the emulsion has been increased and the cost of production measurably lowered.

Two types of asphalt emulsions have been in general use. One is made by emulsification of the asphalt with hydrophilic, or water-loving, colloid, such as a soap solution. This one has the advantage of being easy to manufacture, but it breaks down easily and frequently gives a poor surface or one that is not impervious to water. The other type, made by emulsifying the asphalt in a water suspension of a finely divided insoluble solid such as clay or an insoluble silicate, has the advantage of drying quickly after application and giving a but it is hard to manufacture and breaks down easily.

The need has long been felt of producing an asphalt that would combine the desirable properties of both these general types. After considerable experimentation it was found that asphalt emulsified in soap solution and exhibiting the properties of emulsions of the first type could be treated so as to replace the soap with a finely divided metal tannate, whereby the properties of the second type were exhibited. The new emulsion is as stable as the first type and gives as good a surface as the second.

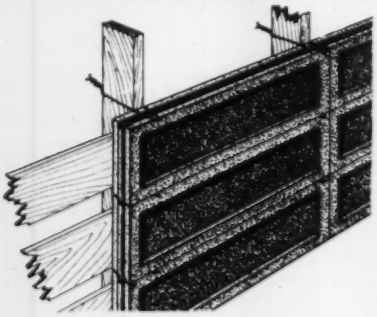
Asphalt-Impregnated Slabs of Concrete in Salt Water

Precast units used for protection against disintegration in tunnels of Seal Beach power plant—Method provides simple construction with slabs comprising the lining of the forms for the wall concrete

By W. R. Shettel
Constructing Engineer, Los Angeles Gas and Electric Corp.

ASPHALT-IMPREGNATED slabs of precast concrete were used to line the outlet tunnels for the recent extension to the Seal Beach steam plant of the Los Angeles Gas and Eletric Corp. to prevent any possibility of disintegration of the concrete by the action of the sea water. Concrete for the lining units was mixed relatively dry and, after curing, the slabs were impregnated with asphalt under heat and pressure by the usual vacuum process. The back side of the slabs are formed with dovetail keyways and, when used as the lining for the forms, they produce a continuous asphaltic lining on the concrete. Since any repairs or maintenance on the concrete work in the discharge tunnels would seriously interfere with operation of the plant, it was considered advisable to provide against disintegration as far as possible. The intake tunnels were sectionalized, making them available for inspection and repair.

Fig. 1—Sketch showing method of laying up lining slabs of asphalt-impregnated concrete against skeleton forms before pouring side-wall concrete.



There is considerable evidence in existing marine structures indicating that some kind of protection against the destructive action of sea water is advisable for most concrete work. Insufficient coverage of reinforcing steel combined with porosity and shrinkage cracks are vulnerable points of attack. If disintegration reaches the point of spalling and definite corrosion of the reinforcement starts, the action is greatly accelerated.

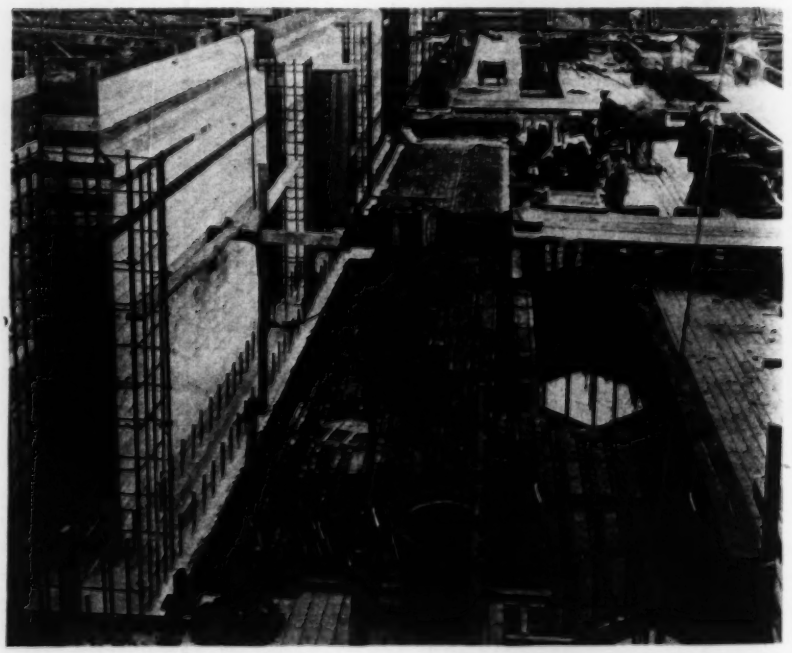
These destructive forces are most severe from low tide line to several feet above high tide. Wave and tide action, together with the alternate wetting and drying, continually change the moisture content in the interstices of the concrete and aid disintegration. The concentration of salts tends to carry the weathering deeper. This process and the results are generally well understood by engineers and need not be discussed further in detail. While it is true that much of the existing marine concrete where disintegration is in evidence was the result of poor work, there remains no definite assurance as to the permanance of the most skillful concrete construction both as to control and placing.

Based on a study of concrete structures in sea water and the requirements of the present development, the engineers decided in favor of using some protection against the disintegration of the concrete in the tunnels of the Seal Beach steam power plant extension, in addition to the essentials of a well-designed and dense mix of concrete. The type of lining selected involved the concrete slabs impregnated with asphalt, which were laid up with hot asphalt filler against a timber falsework to provide a form lining against which the concrete was poured. The layout of the surfacing for walls and columns in the tunnels was similar to any other facing job, and slabs were cast in standard units or in special odd sizes and shapes as required by individual drawings.

Preparation of Slabs—Concrete for the slabs was a 1:5 mix, one part cement being used to equal parts of sand, pea gravel and crushed rock up to a ½-in. maximum size. Mixing was done with a low w/c, producing a slump of about ½ in. The resulting concrete was relatively strong but porous and was placed in forms with the aid of pneumatic tampers. The standard size of slab used wherever possible was 11¾ in. wide by 3 ft. long, with a thickness of 2 in. around the edges and a 1-in. minimum thickness in the central depressed area. These slabs weighed 55 lb. and were easily handled by one man. No reinforcement or metal anchors were used in casting the slabs. The bond to the concrete of the tunnel walls was obtained entirely from the dovetail design of the edges providing the recessed central panel.

After proper curing, the slabs were loaded on cars and run into a drying chamber, and the temperature was gradually raised to 225 deg. F. to remove the free moisture in the concrete. From this chamber the slabs were transferred to the treating retort, where a vacuum of from 23 to 26 in. was applied for a period of one hour to exhaust the remaining moisture and air from the voids in the concrete. The temperature during the vacuum was maintained at approximately 220 deg. F. Asphalt was then admitted with the vacuum maintained, and after filling the retort a pres-

Fig. 2—Slabs for ceiling lining in place on wooden forms ready for concrete. Joints between slabs are tapered and poured with asphalt prior to placing concrete.



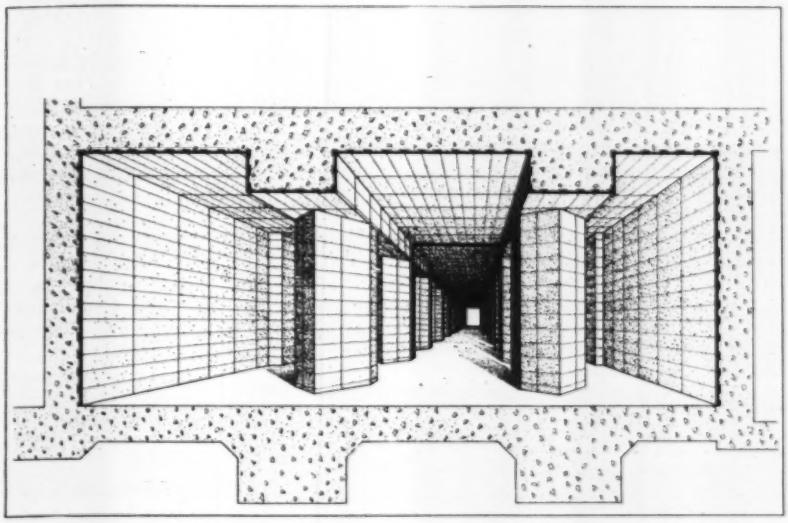


Fig. 3—Perspective sketch of tunnel, showing lining dovetailed to concrete walls and ceiling.

sure of 135 to 150 lb. per sq.in. was applied and maintained for 1½ hours. After this pressure application the asphalt was removed from the retort, and the heat was turned off, allowing the slabs to drain and cool gradually.

A grade D California asphalt was used, having a penetration of about 40 cm. as defined by the A.S.T.M. standard tests. Specifications required a minimum penetration of ¼ in. into the concrete, but slabs actually showed penetrations up to the full thickness.

Method of Erection—On the side walls erection of the lining involved the usual vertical form members, but the timber sheeting was not made continuous. Against this skeleton form the asphalt slabs were set up (Fig. 1), and hot asphalt was poured into the grooved horizontal and vertical joints. The only anchorage used in attaching the slabs to the studding consisted of loops of copper wire extending around the studding and across the groove of the horizontal joints. The setting of the next slab depressed this soft wire into the groove sufficiently to provide bond that proved to be stronger than the wire. Shoring for the walls was used wherever possible rather than form clamps and rods. When rods were required care was exercised to see that the holes through the slabs were properly refilled. Upon completion of the concrete pour and stripping of the forms, the joints were heated slightly with a blowtorch and any open spots were filled with hot asphalt to insure a complete coating.

Ceiling slabs were laid on the usual type of timber forms (Fig. 2). These slabs were equipped with a beveled joint open toward the top, which was filled with hot asphalt prior to the pouring of the concrete forming the ceiling beams and slabs. The lining was not used on the floor of the tunnel because of the protection afforded by a 6-in. layer of concrete over the reinforcing with an additional deposit of several feet of sand. A carborundum saw table was found indispensable for the cutting of special sizes and shapes of the materials used.

Random slabs taken for test specimens were loaded as simple beams with a concentrated load on the center of a 34-in. span. In such a test the slabs indicated an average load of 600 lb. as ultimate strength. Actual tests of the bond between the standard-size slabs and the concrete poured against them and retained by the dovetailed joints showed an average of 8,185 lb. The average 28-day cylinders for the concrete used in the slabs showed a compressive strength of about 3,900 lb.

Engineering direction

The project was designed and executed by the engineering department of the Los Angeles Gas and Electric Corp. under the general direction of H. J. Kister, manager of construction. J. G. Rollow is chief electrical engineer, the author is constructing engineer, with P. A. Patchen as assistant constructing engineer and Walker Philbrook as general foreman. The slabs upon which patents are pending were designed and manufactured by the Pan-Pacific Piling & Construction Co., Wilmington, Calif.

Percolation Slope in Dams Measured by New Device

By L. L. Meyer
Assistant Civil Engineer, Los Angeles Water Department, Los Angeles, Calif.

A NOVEL device for measuring water level was installed by the Los Angeles Water Department in the reconstructed Chatsworth Dam No. 2, to determine the groundwater level or the percolation gradient in any part of this rolled-earth structure. The method uses a system of lines of tubing from well points located in the structure to a recording box on the dam crest where the interior water levels are determined by simple manometer readings. The principle of the device has been used for years in measuring the drawdown of deep wells.

At each point where water-level readings were desired a well point was set in a pocket of packed coarse sand. From these points ¾-in. pipes surrounded with tamped clay packing were extended as the dam was built to a recording box near the crest. Inside of each pipe was a ⅛-in. copper tube terminating near the well point at a determined elevation. The general arrangement is shown in Fig. 1.

As the reservoir fills, water enters the well point and rises in the pipe and copper tube. To determine the elevation of the water in the pipe, air is applied to the copper tube with a tire pump (Fig. 2), and the pressure is measured on a sensitive mercury manometer. As the water surface in the copper tube is forced down, the pressure increases until the water reaches the bottom, after which further application of air will not increase the pressure. The pressure thus indicated is the difference in pressure between the bottom of the copper tube (elevation known) and the water surface standing in the pipe (elevation desired).

The manometer used to measure the air pressure was designed by the author especially for hydraulic testing work and

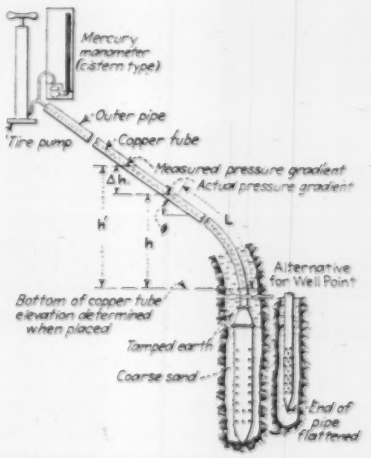


Fig. 1—Diagrammatic set-up of water-level indicator in dam, showing well point, double tube and pump and manometer for measurements.

Fig. 2—Method of taking manometer reading at recording box near dam crest housing ends of pipes leading to well points.

applied to the present device. The scale reads directly in feet of water and is graduated to tenths of a foot (about $\frac{1}{8}$ in. of mercury). The steel base contains a mercury cistern connected to the 2-mm. glass tube. Mounted in a metal case, the instrument is easily transported without removing the mercury and can be read quickly without making corrections.

In taking measurements of water level with this apparatus a small correction (Δh) must be applied to the manometer reading. This results from the fact that the water driven out of the copper tube flows into the outside pipe causing a rise in the water surface. At Chatsworth Dam No. 2 this correction is about $0.029h$. Where the well point is lodged in porous material and the water levels quickly readjust themselves, it may not be necessary to make this correction. The need for such correction can be determined by taking successive readings on the manometer to note if a lowering of the water surface can be detected.

The percolation gradient at Station 17+20 on Aug. 2, 1932, is plotted on the cross-section of the dam in Fig. 3. The record shows particularly the function and effectiveness of the cutoff wall and upstream earth blanket from observations on points Nos. 1 and 2. The ineffectiveness of the 6-in. concrete-facing slab as an impervious membrane was indicated by readings on well points Nos. 3 and 4, which were not used in establishing the gradient. The readings on well points showed the pressure in these tubes equal to the water surface in the reservoir at all times.

Since the device was installed at Chatsworth Dam No. 2 several improvements have been considered. The installation to be made in the new Upper Hollywood dam will have 1-in. copper pipe instead of the $\frac{3}{4}$-in. water pipe. It was found on removing one of the tubes in Chatsworth Dam that some corrosion had taken place due to electrolytic action between the copper tubing and the zinc galvanizing on the pipe. Using copper for both inner and outer tubing should eliminate this trouble. The larger outer pipe will also reduce the correction (Δh) by 50 per cent. This is desirable because of the greater height of the Upper Hollywood dam (65 ft. maximum). For higher dams the outer pipe or still well should be of larger diameter; a 200-ft. dam should have not less than $1\frac{1}{2}$-in. pipe. Where the inner tube is longer than 300 ft., $\frac{3}{8}$-in. tubing should be used to reduce air friction. This is not entirely necessary if absolutely airtight joints and connections can be insured. If a slight leak occurs in the inner tubing, slow continuous pumping is necessary to obtain a reading, and here air friction in the small tube is noticeable.

At Chatsworth Dam the copper tubes were placed inside the $\frac{3}{4}$-in. pipe, length for length, as it was placed up the face of the dam. After construction, a severe leak was discovered in one of the tubes and it was pulled. The tube was 127 ft. long and went around a 90-deg. bend of about 2-ft. radius. After being repaired the tube was greased and inserted again without much trouble. In Upper Hollywood dam the plan, therefore, is to insert the inner tube in the 1-in. copper pipe after it has been placed. To do this easily, the 1-in. pipe is to be placed with bends of 5-ft. minimum radius. The pipe will be profiled accurately so that from the length of copper tube inserted the elevation of the lower end can be determined.

In the coming installation the well point has been eliminated, and the alternative will consist of flattening the end of the copper tube to close it and then perforating the lower 18 in. with $\frac{3}{8}$-in. holes.

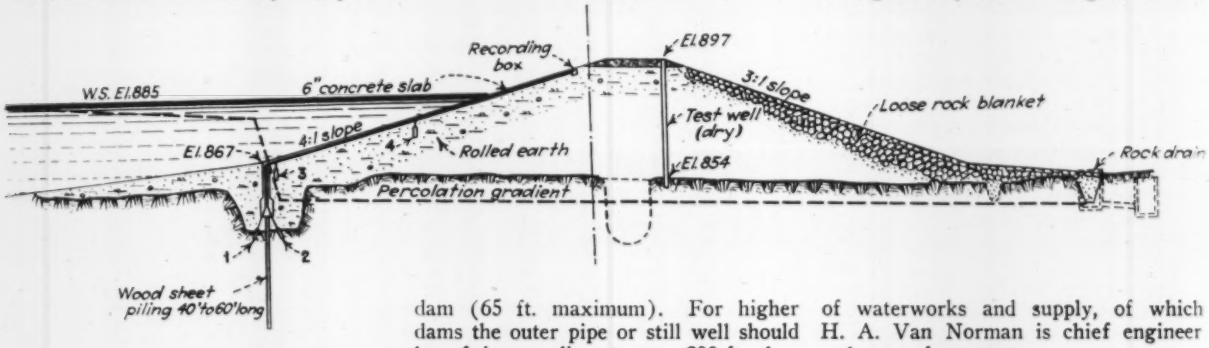
To avoid the use of large cumbersome manometers in high dams, the inner copper tube could be withdrawn until it permits a manometer range low enough to be read conveniently and large enough to provide for ample fluctuation of water surface.

In dams which are longer than they are thick (or high, if concrete) the water-level indicating tubes could be led to one central recording box in the center of the dam and a manometer permanently installed. For long low dams, such as Chatsworth, this is not possible. Here there are four recording boxes with four tubes entering each box. The manometer is connected to the manifold in each box with a rubber hose.

Many of the mechanical details of the apparatus were designed by R. O. Ridenour, junior civil engineer.

Chatsworth Dam. No. 2 was built during 1931 by the Los Angeles bureau of waterworks and supply, of which H. A. Van Norman is chief engineer and general manager.

Fig. 3—Section of Chatsworth Dam No. 2, showing well-point locations and percolation gradient effected by cutoff as indicated by Nos. 1 and 2. Nos. 3 and 4 readings were not considered, as they showed full water head immediately beneath the concrete paving.



Wind-Tunnel Testing for Buildings

Wind-pressure experiments were recently made on a large shed situated at the works of the Metropolitan-Vickers Electrical Manufacturing Co., Ltd., Trafford Park, Manchester, England, and were compared with wind-tunnel tests on a 1/240 scale model of the structure. In the December, 1932, issue of abstracts of papers published by the Institution of Civil Engineers (London) the results of the investigation, which were described by Alfred Bailey in Paper No. 4886, are indicated. It is stated that the tests indicate that experiments on a model building in a wind tunnel do not give all the necessary information for determining the pressures produced by a natural wind on a full-scale building. The general inference is that, while the positive pressures on the windward side of the building are never greater than would be predicted from the wind-tunnel tests, the negative pressures produced on the leeward side are generally greater. This difference, it is stated, may be due to scale effect or to movements in the natural wind not present in the wind tunnel.

Highway and Building Congress Symbolizes Unity

Two days' sessions of combined organizations adopt platform of purpose and action for unified construction industry

THE Highway and Building Congress which assembled in Detroit, Mich., on Jan. 19 and 20 included representation from 21 professional and trade associations allied with the construction industry. At this combined gathering of the leaders of construction the actions of the separate associations on a unifying program and platform of purpose and action were coalesced in a formal text which is printed separately on the following page. The execution of this program and platform was placed in the hands of a plan and scope committee to report to the general congress committee contracted and reorganized in accordance with the new officership of the participating organizations.

Highway congress

Six speakers occupied the program of the highway congress session. Martin L. Pulcher, Detroit, president of the Federal Motor Truck Co. and a member of the National Automobile Chamber of Commerce, declared that the jobs of 3,500,000 men are at stake in the continued improvement, maintenance and use of highway transportation. He said that of these a million are employed in roadbuilding and 2,500,000 in the use and service of the motor vehicle, exclusive of its manufacture.

Roadbuilding has been one of the most effective means of relieving unemployment, he added, and at the same time of providing a needed economic service. The highway building program cannot be eliminated.

Grover C. Dillman, Michigan state highway commissioner, said, "Our state highways need, first of all, assurance of funds that will not be tapped by organized groups seeking easy money for purposes foreign to those intended by imposition of the special taxes."

We are just getting to the point, he added, where our balanced programs can give some consideration to secondary roads. Yet, as we approach this point, we are faced with serious economic conditions in our whole industry. Long-term planning makes possible a better accounting system resulting in economy in financial plans.

Chester H. Gray, Washington, representing the American Farm Bureau Federation, said that farmers are dependent on continued progress of road construction. He attacked "excessive taxation," which he said was forcing users to give up their trucks and cars.

Pleas were voiced for continuance of highway construction by Thomas H. MacDonald, chief, Bureau of Public Roads, and Willard Chevalier, of the McGraw-Hill Publishing Co.

Movement of produce from 6,000,000 farms in the United States is entirely dependent on public roads, asserted Mr. MacDonald. He said motor trucks were used almost exclusively in moving the $12,000,000,000 worth of crops in normal annual production.

He said that the tourist traffic in 1930-31 brought 2,500,000 automobiles into Michigan, with an approximate expenditure of $270,000,000.

He said that it would be disastrous to hamper the activities of state highway departments during the months that lie ahead, as road maintenance is so vital a factor in present-day life. "Economic recovery cannot be helped by a breakdown in our sound highway administration policies," he concluded.

Colonel Chevalier said that roadbuilding advances made in the last 25 years have revolutionized society, with individual transportation, as exemplified by automobiles, making startling strides.

An opposition note was struck by Ernest N. Smith, Washington, executive vice-president of the American Automobile Association and vice-chairman of the National Highway Users Conference. He demanded that constant pyramiding of motor levies cease and that receipts from motor taxes be limited to highway purposes.

Construction congress

Three addresses on unifying the construction industry led off the program of the congress on construction. A. P. Greensfelder, of the Construction League of the United States, spoke of the work of that organization and of its possibilities as a unifying factor in the industry. Discussing the problems of the subcontractor in detail, Oscar Reum, of the Contracting Plasterers' International Union, and P. W. Donoghue, of the National Association of Master Plumbers of the United States, supported the purposes of any undertaking to harmonize and unite the elements of the construction industry.

A. E. Horst presented in detail the objectives and procedures of the "Renovize Philadelphia" campaign. This paper covered virtually the same information as was given in Mr. Horst's talk before the Associated General Contractors, which is summarizd elsewhere.

An address by D. H. Sawyer, director of the federal employment stabilization board, Washington, described the purpose and operations of his bureau to develop a six-year national construction program. Commenting on the possibilities of this objective, Colonel Sawyer said:

"It is possible, in my judgment, to make public enterprises a vehicle for greater stability in the volume of construction than has been recognized in the past if improvements will be anticipated several years ahead and allocated with judgment and discretion to periods of prosperity and depression.

Economic recovery through construction was the subject of a talk by E. J. Mehren, president, Portland Cement Association. Geo. B. Walbridge, Associated General Contractors, spoke on stimulating construction recovery by proper legislation, and a talk on rebuilding blighted areas was made by Robert D. Kohn, Construction League of the United States.

Congress dinner

In the formal addresses at the Congress dinner on Jan. 19 further emphasis was placed on leading factors in the forward view. Robert D. Kohn, General chairman of the Construction League, spoke of the high significance of unity and coordination and remarked that heretofore the construction groups have not been working together but have been fighting in a devil-take-the-hindmost spirit that is responsible for our present condition. He also referred to the new need for planning, and said that in future we should not build cities where they are not wanted or recklessly extend them at the perimeter. Planned production ought to begin now in the field of construction. To this end, he declared, the industry needs boldness: *"de l'audace, de l'audace, et encore de l'audace!"*

H. I. Harriman, president of the Chamber of Commerce of the United States, spoke of the direct interest which the Chamber is taking in construction. Otho M. Graves, toastmaster, had referred to the Chamber as an unlighted crossing lantern so far as construction is concerned, but Mr. Harriman said that the lantern would promptly be lighted. We must not look upon depressions as uncontrollable but consider that the same study which controlled cholera and typhoid can teach us to temper economic epidemics. Looking back at the three chief reasons given for the depression—that in prosperity too little of production's surplus was given to wages and too much to extension of production facilities, that labor was displaced by machinery, and that credit was excessive—he asserted that the im-

mediate cure is restoration of normal price levels. As instruments to this end he suggested restoration of foreign trade, reduction of government expenditures to balance income, unshackling business, solution of the farm problem, and the establishment of stable money. Senator A. W. Barkley, of Kentucky, in a fiery address on "Who are the Builders" reminded his hearers of the fact that the builders of the United States did more to unify the country and make it livable than all the politics and politicians. He pointed out that tastes, desires and ambitions in building have gone hand in hand with civilization and will conitnue to change and will ever demand new construction; and that this nation will never be finished until it begins to decline.

Construction's Proposals for a Way Out

RESOLUTIONS fostered by 21 national construction organizations urge public works for employment, liberalization of the Relief Act, charging of improvements to capital account, continuation of federal aid for highways, elimination of gas-tax diversion, low-cost housing and a federal department of public works.

IN a series of 23 resolutions the construction organizations that took part in the highway and building congress at Detroit last week presented a program for business recovery. In addition, they initiated direct action toward laying the foundation for a united construction industry by setting up a plan and scope committee to work out plans for immediate progress.

The resolutions for re-employment and business recovery follow in full.

"Recognizing the gravity of the existing business emergency and desiring to assist in relieving it, we, the construction industry of the United States, as represented by 21 national organizations meeting in joint session in Detroit, Mich., Jan. 16 to 21, 1933, hereby adopt this platform of policies and measures for employment and business recovery. Construction is among the nation's largest industries, and the revival of its activities will determine in large measure the recovery of prosperity. We confidently believe that general conditions are now favorable to resumption of business in its normal channels, if prompt and effective action is taken.

1. We are unalterably opposed to the dole system and strongly advocate in lieu thereof, first, an immediate construction program of sound and needed public and semi-public improvements, and second, the adoption of such measures as will hasten the resumption of private construction and industry. Among the public and semi-public projects are highways, waterways and other forms of transportation, flood control, housing, sanitation, waterworks, sewerage and refuse disposal, public buildings and other similar projects.

2. We demand maximum economy in the current administrative and operating expenses of government, as well as an increased program of public works financed out of capital account. To further this end we urge that, wherever possible, the investment of the national government, states, cities and other governmental subdivisions in permanent improvements be charged into capital account as is the practice of private industry, and that only the necessary carrying charges and amortization be included in current operating budgets.

3. In view of the ineffectiveness of the construction loan operations that have been carried on under the Emergency Relief and Construction Act, we advocate liberalization of self-liquidating requirements and reduction of interest rates by suitable amendments of that act.

4. We appeal to states and municipalities to enact immediately legislation that will place upon a self-sustaining and self-liquidating basis, through service charges, such public services as sewerage and sewage disposal.

5. We urge that all public agencies engaged in distributing relief funds adopt the policy of applying these funds wherever possible through planned useful work instead of through welfare doles.

6. We urge the extension of the date of completion of emergency federal-aid highway work from July 1 to Oct. 1, 1933.

7. We deplore the proposal that federal aid to state highway improvement be curtailed or suspended at this time, and we urge Congress to continue the federal-aid policy by appropriating during the present emergency a sum equal to that appropriated last year, and in any event not less than the revenues from federal taxes on gasoline and tires.

8. We demand that the revenue raised from motor-vehicle fuel taxes and license fees be used exclusively for highway construction and maintenance, and we oppose the diversion of these fees and taxes to other purposes.

9. We advocate the extension of federal aid to those portions of state and federal-aid highway systems within city limits, and we recommend such allocation as will give a fair proportion of the highway funds to municipalities for streets and roads within their corporate limits.

10. We indorse the proper and reasonable regulation of highway transportation, such regulation to be premised on sound economics and not on a desire to establish parity of cost with other forms of transportation.

11. We urge that all necessary measures be undertaken to promote the construction of adequate low-rental housing and that the states enact legislation to grant the power of eminent domain for this purpose.

12. Believing that the heavy interest charges of fixed obligations are a serious obstacle to early credit restoration, we urge, as an essential of economic recovery, that interest rates on such fixed obligations be reduced and adjusted by negotiation to conform to the general price level.

13. We recommend that the federal government and the several states amend their bankruptcy and related statutes to simplify the process of reorganizing public and private financial structures by providing that approval of a substantial majority of bond or other certificate holders shall be sufficient to authorize such reorganization.

14. We urge that state laws and municipal charters be amended to permit deferring payment for at least two years of the initial instalments of special assessments upon benefited property without penalty and at moderate interest.

15. We indorse the Uniform Mechanics Lien Act prepared by the Standard State Mechanics Lien Act Committee of the United States Department of Commerce and the National Conference of Commissioners on Uniform State Laws, and urge the enactment of this legislation by state legislatures.

16. We urge that the government cease engaging in any form of business and service not clearly necessary to the administration of governmental functions.

17. We urge that the United States Congress establish a national department of public works.

18. In view of the vital relation of construction to public welfare, we urge that standing committees on construction be set up in both branches of the Congress of the United States, similar to those of agriculture, finance, etc., so that Congress may be enabled to act with greater knowledge and broader judgment on construction matters.

19. Believing that public and semi-public works can be carried out efficiently and economically only under a coordinated and balanced program of national, state and municipal works, we urge comprehensive advance planning of public improvements accompanied by long-term financial planning as the soundest policy of conducting public works; and that legislation to carry out such policy be enacted.

20. We favor the enactment of an emergency general-sales tax as a means of reducing other forms of taxation and furthering the program of public and semi-public inprovements that we advocate.

21. We recommend that if further financial measures are found necessary to restore employment and value, consideration be given by Congress to the establishment of a rigidly controlled increase of circulation by issue of currency based on labor and materials actually expended in useful construction, such currency to be issued only as compensation for work completed.

22. To give more immediate aid to the unemployed, we urge all communities to plan and put into effect an intensive campaign of rehabilitation and repair.

23. While recognizing the urgency of reducing unemployment, we demand that public work be performed by the most modern and efficient methods, and we oppose the indiscriminate substitution of hand labor therefor."

A.R.B.A. Stresses Technique of Roadbuilding

Reports cover all phases of highway development and reach a volume and quality exceeded only by the outputs of the 1931 and 1932 conventions

A REVIEW of 700 or more pages of technical data and discussion comprised in two-score committee reports and papers presented at the convention sessions of the American Road Builders' Association exceeds the bounds of reasonable summary. To give mention to all would result in abbreviation that would make the result worthless. The purpose here, then, has been to select for consideration a few, not as representing superiority over others but rather as presenting a subject or a phase of a subject having distinct novelty or timely interest. Even with this limitation, the condensation results in great abbreviation.

County road administration

The activity in movements to eliminate county direction of highway improvement and centralize it in state highway departments gives special interest to the study of the administrative and financial relationship in highway matters of state and county made by the county committee headed by W. O. Washington, county engineer, Cameron County, Tex.

County control of county road systems is in this report predicated as follows: Because of the danger of bureaucracy through concentration of authority over all roads in the hands of the state highway departments, and because of the easy opportunity to build up a powerful political machine based upon the administration of road funds if concentrated under the authority of state highway officials, and because county highway systems are fixed in counties and must be designed primarily to serve county conditions and only secondarily as feeders to state highway systems, and because it is reasonable that a democratic people control the administration of their county and local highway expenditures, jurisdicition over county and local roads should be placed with the county board, and the state highway department should be established in a consulting capacity with respect to county and local road work.

On this preamble it is recommended that definite coordinated fundamental highway policies should be established by the states and counties.

In order to enable legislatures to reorganize county administration or consolidate counties by general laws and adapt them to the administrative needs of the states, all provisions specifying or establishing particular county offices should be eliminated from state constitutions. Legislatures, in legislating for the counties, should refrain from providing in detail for matters that should be left to local determination.

There should be one general law for the whole of each state, establishing the principal units of county organization, with options provided in certain cases to be adopted only with the approval of a majority of the qualified electors of the county. There should be adopted by the legislatures, or embodied in the state constitutions, sound classifications of counties, and all legislation relating to county administration should refer back to this pre-established classification. Consideration should be given to the possibility of eliminating unnecessary offices by consolidating adjacent counties.

County and local highway improvement should be based upon the theory that the county road is designed primarily to fit special local conditions, and only secondarily as a feeder to state highway systems. With respect to county functions, responsibility should be centralized in the governing boards of the counties. It should be clearly stated in the state laws that the county commissions are to possess and exercise general supervisory authority over county and local highway administration. County uniform accounting systems and budgets should be mandatory by state law.

In considering justification for county and local road improvement, other values than the purely economic may have greater weight. State highway departments should be placed in a consulting capacity to county highway departments, similar to the relationship between a consulting engineer and his client. County commissions should be relieved of all duties in connection with the appointment, removal or compensation of subordinate employees in county highway activities.

Two or more counties should be permitted and encouraged to cooperate in the employment of a county engineer. The county engineer should be left free to organize the road work of the county according to its needs, without regard to commissioners' districts, precincts, beats or other subdivisions.

County and local highway construction funds should be established by state law, and diversion therefrom should be prohibited by penalty. Counties should be the recipients of state aid from the vehicle fees and gasoline tax revenues and should not be compelled to forfeit control over road work on which such expenditures are planned or proposed to be made. State highway departments should complete systems of state highways as now planned before adding more mileage.

Fillers for brick roads

The subject of fillers is perhaps the most discussed problem and the question on which there is the greatest difference of opinion, according to the report of the committee on brick pavement headed by H. G. Sours, county engineer, Summit County, Ohio. A hard asphalt is generally considered the most satisfactory of the bituminous types. Emulsions have been experimented with considerably during the past two years, but in general have not proved satisfactory due largely to the uncertainty of the results. Emulsions, however, have a distinct advantage in refilling jobs where it is necessary to do the work during bad weather.

The most interesting development in the filler problem is the removal of the excess material from the surface of the pavement. The Ohio state highway department, in connection with the brick manufacturers in Ohio, did considerable experimental work during the season of 1932, using different materials and methods. The principal materials used were a solution of lime, a patented material known as B & B and manufactured in Cleveland, and a solution of calcium chloride. Where lime was used, approximately one sack per 1,000 sq.yd. provided enough solution. Where the B & B material was used, it required approximately 0.3 lb. per square yard. Calcium chloride was made up in a solution of approximately 65 per cent water, 35 per cent calcium chloride, with a small amount not to exceed 1 per cent of laundry starch.

Several methods were used in applying the material to the surface of the brick. In some cases it was put on with a padded roller that was saturated with the solution, in other cases it was brushed on with ordinary push brooms. The method that seemed to meet with most favor was that of spraying it on through a fine nozzle, the solution coming through the nozzle in the form of a fog.

The filler should be poured on the brick rather than applied with squeegee buggies, as it is easier to remove the material in thick sheets or strips. The asphalt should be applied while the surface of the brick is still wet and should be peeled off as soon as complete settlement has taken place in the joints. It is best removed with straightened hoes used as cutting tools; it should be cut in strips about three bricks wide and

approximately 5 ft. long. The cutting off in small strips makes it easier to handle and overcomes the tendency to pull some of the material from the joints, as sometimes results where too large a sheet is being handled. The material can then be put into the kettle and reheated. Tests have not revealed that any appreciable difference results from the small amount of the solution that might be absorbed in the asphalt after it has been reheated. It is advisable, however, to use at least 50 per cent new material in the kettles.

Some experimental work has been conducted with grout fillers. In Mahoning County, Ohio, concrete base was constructed with transverse contraction joints at regular intervals and longitudinal flush concrete curbs at 10-ft. intervals. A longitudinal joint along the concrete curbs takes care of cracking. Over each contraction joint and along each curb, expansion joints were installed. The bricks were then grouted in place. This provided grouted slabs of brick pavement completely separated from the base by cushion and from the sides and ends by the slab expansion joints. On some other work in Ohio the same system was adopted for the transverse joints. The longitudinal joint was constructed by laying the brick up to a board or thin strip of metal lined up over the longitudinal joint in the base. After grouting, the strip was then pulled and a bituminous joint poured.

Some experimental work has also been done with a material known as temperature-resisting cement. The material is a mixture of ordinary cement and bituminous materials manufactured under a patented process. The theory is that the material has more flexibility, which tests have proved, and that it will be able to take care of both expansion and contraction without cracking.

Asphalt emulsions

The growing use of asphalt emulsions in macadam types of surfacing is based on special qualities that distinguish it from other liquid asphaltic materials. Following a brief definition of the material, the committee on asphalt emulsions summarizes reasons for its use.

Emulsified asphalt is pure refined asphalt of any desired grade dispersed in droplets of microscopic size in water with the aid of extremely small quantities of emulsifying agent, which does not affect the physical properties of the asphalt. The water is in the "continuous" phase—that is, it surrounds the droplets and gives fluidity to an asphalt which at the same normal temperatures would be a solid or semi-solid. The relative percentages of asphalt and water are varied to give the required fluidity for the particular use for which the product is intended.

Emulsified asphalt differs from cut-backs in that cut-backs are a solution in which semi-solid asphalt is dissolved in volatile or partly volatile solvents previously extracted from petroleum oils in refining.

Emulsifying permits the cold handling of paving asphalt. Emulsified asphalt is shipped, stored and applied at normal atmospheric temperatures. The cost of heating is, therefore, eliminated and also all possibility of damage to the asphalt through careless over-heating in the field. Withdrawal from cars can begin immediately on arrival at destination, speeding up work and minimizing delays.

Emulsified asphalt contains no cutting agents or solvents, and the coating deposited on the stone is, therefore, pure asphalt. Any desired grade of asphalt can be obtained in the emulsified asphalt form. The asphalt contained in the emulsion is always deposited in thin films, excesses, if any, flowing through to the subgrade where no damage to the pavement can result. Thin films hold the surfaces of the stone in close contact, thus developing the utmost frictional resistance to displacement, resulting in maximum stability in the pavement.

Soft, sticky, ductile asphalts are used in emulsified asphalt, due to the fact that the stone particles are not separated by thick coatings and that no excess asphalt is present in the voids between the stone particles. It is not necessary to use hard brittle asphalts to avoid displacement or bleeding.

By varying the viscosity of the emulsified asphalt and the number of applications, any desired thickness of coating can be placed on the aggregate. With emulsified asphalt it is entirely practicable, indeed essential, to fill the voids with clean dustless chips, with the result that greater density and stability are secured and the presence of excess asphalt is entirely avoided. This accounts in a large measure for the long continued uniformity of riding surface and also for the remarkable waterproof qualities found in this type of work.

In penetration work, due to its fluidity and the absence of a tendency to congeal on coming into contact with stone, it permits of penetration to the bottom in thick pavements, after the voids have been filled with dustless stone chips. This filling of voids is the outstanding difference in practice in the construction of emulsified-asphalt penetration work.

Emulsified-asphalt roads are invariably non-skid in texture and remain that way, even under heavy traffic.

Emulsified asphalt can be used in the penetration type of work in cold weather and may be applied to wet stone in all types of work. By eliminating time lost waiting for aggregate to dry and by lengthening the construction season, economies are effected and delays reduced, which are of importance to the contractor and to the traveling public, although difficult to evaluate definitely. Winter grades of emulsified asphalt are available that can be used for maintenance in freezing weather.

Application equipment for this low viscosity binder is simple and inexpensive, and because of its simplicity not liable to cause delays. Heating apparatus on distributors is not required, although any standard type of distributor may be used. Simple hand pumps are often found economical and are used for small jobs or where hand labor is to receive maximum use. In maintenance work small pressure tanks with a hose and hand nozzle are in common use.

Emulsified-asphalt construction requires the use of fine stone chips down to ⅛ in. in size, as well as the coarser stone, thus utilizing practically the entire output of the crusher without waste.

Low-cost residential streets

Stating that low-cost residential streets are just as adaptable to modern traffic as high-type pavements, the committee on maintenance, of the city engineers' division, headed by Major F. M. Davison, maintenance engineer, District of Columbia, presented a table of carrying capacities of the various types. This table is based on a percentage basis for comparative cost of low-cost residential streets with respect to high-type slabs or surfacing, costing an average of $2 per square yard.

Costs covering grading and drainage have been eliminated from consideration in both types, assuming that all engineers know that a good grade and adequate drainage are primary essentials for any type of street, whether low cost or high type.

These low-cost, residential-street comparative percentages of cost cover only surface or slab construction and no curbs, gutters or catchbasins.

Equipment advance

Five committees reported on equipment for low-cost road construction.

COST AND TRAFFIC CAPACITY OF LOW-COST TYPES OF RESIDENTIAL STREETS COMPARED WITH $2 PAVEMENT

	Per Cent of Cost of Construction Compared with High-Type Cost	Vehicular Capacity. Cars per Day*
Stabilized roadway.....	15	175
Stabilized roadways primed with bituminous material	18	225
Stabilized roadways primed and with single surface treatment of bituminous material.....	23	400
Stabilized roadways primed and with double surface treatment of bituminous material ...	25	650
Stabilized roadways primed and with bituminous material mixed-in-place, 3-in. compacted	39	1,800

*Capacity is based on preponderance of passenger cars, with heavy truck traffic not exceeding 5 per cent.

Developments and mechanical improvements, generally, were covered in the report of the committee headed by John D. Waldrop. Greater heating efficiency, more effective screening and more accurate weighing are features of central plants for bituminous mixes. Traveling plants of the same type show improvements in production speed and uniformity of product. For mixed-in-place, or retread work, progress has been made in multiple control of blade, circle and wheels of tractor-drawn and motor graders. One new machine is equipped with a revolving element in front of the grader blade to insure a thorough mix. Several new types of disk harrows and spiked-tooth harrows for bituminous road mixes are proving effective.

For spreading stone and chips, powered machines are in use, among them one fed by a belt conveyor delivering to the front of the truck. Spreader boxes and revolving drum spreaders have been improved, and some states employ a steel fan-tail spreader on the rear end of a truck.

Mechanical finishers are available for both cement concrete and bituminous mixes. Several new types of plant are available for coating aggregate with emulsions or cut-back asphalts by immersion. Six-cylinder engines for road rollers insure smoothness and flexibility of operation.

Truck mixers with special distributing devices are well adapted to building roads of the mortar-bound macadam or the comparatively new bituminized cement types, involving the application of a grout mixture to stone in place.

For utilizing stone along the roadside, portable crushing and screening plants are available.

Pressure distributors, according to a paper by William E. Worcester, have been improved by providing for the safety of operators, by preventing undue coking or oxidation of bitumen, and by controlling the application of material in uniform quantities. These features involve the use of relief valves, gas vents, insulation, circulating and agitating systems to equalize the temperature of the heated bituminous material. Pumps are governed to deliver a steady, non-pulsating flow at the nozzles.

For spreading and finishing pavement surface the report of the committee headed by O. L. Kipp presented a long list of improved equipment. Reliability of power and the mechanical operation of controls are notable features of equipment for preparing the subgrade. On finishing machines improvements consist of an automatic form spader and a vibrator screed; this equipment permits the use of a low water-cement ratio concrete and removes entrapped air from the mix. For removing laitance a long-handled straight-edge is effective. The placing of wire or bar-mat reinforcement is simplified by a screed, pulled by the finishing machine, which strikes off the cement 2 in. below the finished surface. Longitudinal, instead of transverse, floating improves the riding surface of concrete pavements. Experiments are in progress using a tandem roller to consolidate a very dry, lean concrete mix. Several mechanical devices have been developed to spread transit-mix concrete. Machines for finishing road shoulders are an improvement over hand methods.

A committee headed by B. C. Tiney maintenance engineer, Michigan state highway department, reported on standardization of material for grader blades. The use of high-priced alloys in blades does not appear to be justified by increased wear. The maximum value in blade material can be obtained from a steel of 0.8-1.0 per cent carbon and 0.6-0.9 per cent manganese.

Road Equipment Exhibits Unusual Refinement

Equipment less in volume but machines greatly advanced in design and mechanical control—Light-weight and abrasion-resisting alloys, welded frames, anti-friction bearings and improved power units are outstanding

EXHIBITS by 121 manufacturers of equipment and materials, in addition to about a dozen displays featuring federal, state and county highway activities, constituted this year's highway and building exposition—the road show of former years—held in the municipal airport at Detroit during the highway and building congress. In number of exhibits and amount of machinery actually on display the show reflected the contracted volume of last year's roadbuilding and general construction business.

Heavy equipment on the airport floor was confined mainly to the blade and elevating grader types, motor trucks and tractors. Lone representatives of the batching plant and portable rock-crushing and screening-plant divisions had equipment on view. The big power shovels, cranes, concrete mixers, air compressors and similar heavy machines that were a feature of former shows were absent this year. While the heavy-duty machines themselves were missing, their manufacturers were represented at booths featuring photographs and other informative data indicating that many refinements and improvements have been developed in spite of the current construction slump. The visitor to the show left with the definite conviction that the year 1932 had produced construction equipment redesigned and improved in essential parts to do better and easier work. General types of equipment show no radical changes. The advance has been in mechanical refinements, all designed for greater output, operating efficiency, increased strength and the elimination of lost time in the field for service or repairs.

In all probability the outstanding general development has been the application of power control to equipment in the blade and elevating grader class. Today's operator, thanks to the machine designers, has had his work vastly simplified for him. Instead of tugging at levers and straining at hand wheels, he sits before a power-control panel and with the pressure of a finger makes the modern machine do his bidding.

Multiple speeds have been introduced to make machine operation more flexible, frames have been strengthened by electric-welding instead of riveting, power has been conserved by the use of anti-friction bearings, and lightness and strength are combined in the use of alloy steels. Diesel power has made its entry into the field alongside of the gasoline engine.

Bituminous products were the leaders among the roadbuilding materials represented at the show. Particular stress was laid upon their application in the construction of low-cost roads, for which a definite trend has developed. Considerable interest was displayed in a bituminized cement for low-cost road construction. Of outstanding importance, also, was a device for improving the strength and wear-resisting properties of paving brick by removing air from the clay before it passes through the die.

Grading and hauling equipment

Hydraulic and mechanical power control is the outstanding improvement on this year's road grader. Motor graders with dual drive, six speeds and diesel power are available. Without muscular effort on the part of the operator angles of blades may be adjusted, frame shifted on rear axle, scarifier raised or lowered, and steering done, all by hydraulic or mechanical power control. For steering, some of the new graders have dis-

placed the old fifth wheel and for it substituted pivoted axles similar to those on a modern automobile.

Elevating graders now have wider carrier belts (48 in.), which are driven by separate power units, insuring greater output than when the drive was taken from the wheels of the older types of machine. Adjustments of the position of the carrier booms are now made by power, as is the adjustment of the cutting disk. Another improvement is in the form of a cat hole cleaner of the chain and paddle type.

For cutting, spreading and leveling earth, scraper units up to 6 yd. in capacity are designed for haulage by tractors. Their operation is controlled by hydraulic equipment.

Sizes of crawler and wheel-mounted wagons have been stepped upward to capacities of 10 or 12 cu.yd. Two-way steel dumping bodies have been developed for this equipment. Other improvements include demountable wheels, heat-treated crawler shoes, alloy steel parts and rigid frames.

Diesel power has entered the tractor field and is available in machines of 50 and 70 hp. Recent improvements include oil seals to exclude dust and dirt from track wheel bearings, multiple speeds (eight in one case, including six forward and two in reverse) and operating conveniences in the form of adjustable pedals and single gear-shift levers. Designs have been altered to provide greater visibility for the operator. Controlled differential steering is another new feature, and filters are provided to exclude foreign matter from air, fuel and oil.

A great variety of pressed-steel bodies for large and small trucks has been designed, including both two-way and three-way dump bodies operated by hydraulic hoists. Special heavy-duty reinforced steel bodies of large capacity are the products of demand for handling rock in large loads, as at Hoover Dam.

Bituminous road equipment

To increase smoothness of operation and flexibility, gasoline road rollers are now powered with six-cylinder engines. Steering and scarifier control by hydraulic power are recent improvements. Vibration tending to impair the smoothness of the surface rolled has been controlled by spring mountings, both for the engine and for the front roll and yoke.

Designers of tank trucks for bituminous construction have made progress in insuring accurate, uniform applications of both hot and cold material to the road surface. The modern machines carry trucks with governed speeds producing a steady, non-pulsating flow of bituminous material to the distributing nozzles. Tachometers have been introduced to indicate to the truck driver the proper speeds at which to operate.

During the last couple of years a marked development has occurred in blade drags for mixing bituminous road surfaces in place. One of the latest of these devices is a retread mixer and leveler of exceptional size, with a steel frame 24 ft. long and 12 ft. wide, equipped with staggered diagonal blades. The equipment weighs more than 4 tons and is of bolted construction, so that it can be knocked down into sections for transport from one job to another. It is carried on long steel runners that may be raised or lowered by hand-wheels and screws. There is a leveling blade at each end of the frame.

Both stationary and traveling plants for bituminous road mixes are ready for the contractor's use. One of these picks up crushed stone, laid in windrows on the road, raises it by bucket elevator to a mixing element and discharges and spreads it in the wake of the traveling plant.

Another type of plant for coating aggregate with asphalt maintains a bath of asphaltic binder at the bottom of a slowly revolving drum into which a continuous regulated stream of aggregate is fed. Coated aggregates are picked up by perforated buckets and discharged through a perforated chute into a screen delivering to a storage hopper.

Concrete paving equipment

For concrete paving several new devices have been developed. One is a concrete spreader that distributes uniformly between the forms batches delivered by truck-mixers. The feature of this device is a receiving hopper that delivers to a pair of lateral spiral conveyors. Steel forms may be tamped by a mechanical device riding upon them. In the newer finishing machines the heavy screeds may be raised or lowered by hydraulic instead of hand power to speed up the production of the machine on jobs where tandem mixers or truck-mixed concrete is used. Another innovation, not yet in general use, is a finishing machine with a vibrator mounted upon the screed, designed to handle dry, lean-mix concrete. Finishing machines are now equipped with both center and side controls. There is also a mechanical form spader on the market. Depressions or bumps in concrete paving surfaces may be detected by a variety of mechanical devices. Humps can be smoothed down by surface grinders.

One manufacturer has produced a machine for pumping concrete through a pipe line at rates of 20 to 40 cu.yd. per hour. The equipment will deliver to a pipe line 500 ft. in length or against a vertical lift of 75 ft. Machines of this type are in operation at the Hoover Dam.

Materials and accessories

In the manufacture of paving brick a radical improvement has been introduced by incorporating in the process a machine for removing air from the clay before the brick is burned in the kiln. This de-airing equipment, which operates on the clay just before it is extruded from the die, produces a denser, slightly heavier (4 per cent) brick, having greater resistance to wear and less porosity than brick as formerly made.

Bituminous materials, including both asphalts and tars, were widely used last year in the construction of low-cost roads. Material for both hot and cold applications was on display. Non-skid characteristics are claimed for certain of these products. Others have been designed particularly for application during cold weather.

In addition to the commonly used premolded asphaltic jointing material, there is manufactured an expansion joint of cork composition, which, it is claimed, is not softened by high temperatures and cannot be squeezed out by the expansion of the abutting pavement ends.

Bulk cement is coming into wider use in roadbuilding work, and improved equipment simplifies the unloading of this material from railroad cars and its delivery by pumping to overhead bins for batch weighing.

For stabilizing gravel roads, reducing dust and preventing loss of surfacing material, calcium chloride has been found effective, and the best ways for using it have been developed by research and field tests.

In addition to various types of wire rope, offset from supporting posts, developments in highway guard-rail have taken the form of various types of steel bands, some of them held to the posts by spring connections to reduce the force of vehicular impact. Flat bands of wire strands also are used. As a substitute for wooden supporting posts, posts of pressed steel have been developed carrying wire attachment devices.

Departmental exhibits

Educational exhibits by the U. S. Bureau of Public Roads and a number of the state and county highway departments added decided interest to the exposition. The federal bureau, in its "slightly allegorical exhibit," pictured the destructive effects of the "four horsemen," Abrasion, Suction, Shear and Impact. In the development of road construction, abrasion has been conquered by equipping vehicles with rubber tires, suction has been vanquished by bituminous surfacing, shear has been defeated by reinforcement, rigid pavements and new firm subgrades. Impact is still doing damage but is being curbed by producing roads having smooth surfaces.

Highway department exhibits included those of New Jersey, Ohio, Michigan and Ontario, Canada. There was also an exhibit by Wayne County, Mich. These displays took the form of models of road and bridge construction, charts, diagrams and statistical data, supplemented by photographs indicating the character and scope of departmental construction and maintenance.

Municipal Engineers Discuss Current Problems

Papers presented at Detroit cover city planning, water, sewage, garbage, pavements, traffic control, municipal finance and desirable legislation—All discussions colored by prevailing economic conditions

THE ANNUAL convention of the American Society of Municipal Engineers—originally planned for last November in New Orleans but postponed—was held during the first three days of the week. Following the trend toward a broad coverage of municipal engineering subjects by the society during the last few years, and particularly since the change of name from "municipal improvements" to "municipal engineers," the technical content of the 30 papers in the six sessions included city planning, sewage and waste disposal, water supply, municipal field engineering, street paving, traffic control, airports, street lighting, street design, highway sidewalks, finance and unemployment. Although it formerly devoted its major efforts toward paving and street work specifications, a comprehensive review of all the varied activities of the city engineer was reflected in this year's program.

All of the general papers and discussions, particularly the opening addresses and that of President John H. Neeson, in his annual review, stressed the prevailing economic conditions and the engineer's peculiar relation to them. More than ever those having to do with municipal affairs have become "money conscious." Answering the question as to why the engineer stays in city service, he gave three reasons: No other field gives such wide experience; here the engineer sees work initiated and consummated; and, ordinarily, civil service employment offers great security of continuity. With reference to society activity Mr. Neeson called attention to the formation of the chapters of Philadelphia, Chicago and New Orleans, and further activity looking toward chapters at Pittsburgh, Boston, Milwaukee and Toronto. Chicago, the latest one formed, has embarked on a series of meetings designed to help the engineer to sell the engineering works of the community to the citizen.

In the report of C. W. S. Sammelman, executive director, it was stated that the increase in membership by 163 during the year brought the total to 881. The change of the annual meeting from New Orleans to Detroit was a move in the interest of economy as well as to assist the highway and building congress activity. Announcement was made of five engineers, who, by virtue of being members for 30 years, had become senior members and are exempt from paying further dues. They are T. Chalkley Hatton, H. P. Cleveland, C. D. Pollack, E. S. Rankin and Robert Ridgeway.

Veterans' award

Recognition of long-time service is acknowledged by the society each year by the presentation of medals to those members who have served a single municipality for 30 years. The award is made possible by an endowment founded by S. A. Greeley. This year the awards went to Morris R. Sherrerd, consulting engineer, water department, Newark, N. J., to R. A. MacGregor, engineer of maintenance, highways and sewers, Borough of Manhattan, New York City, and S. Cameron Corson, superintendent, sewage-treatment plant and of parks, Norristown, Pa. Mr. Sherrerd has served Newark continuously since 1895, Mr. MacGregor, New York City since 1897, and Mr. Corson, Norristown since 1899.

City planning and airports

The city planning committee, headed by Thomas Buckley, assistant chief engineer, Philadelphia bureau of engineering and surveys, anticipates that the reconstruction period now under way will bring about a new era in city planning. The opportunity presented will be for applied city planning rather than for making additions to the well-established planning theories. The engineer was urged to bend every effort toward the development of ways and means of transforming sound theory into concrete fact. He should seek to direct the motive forces that determine city building in such successful fashion as to control the extent of municipal growth while satisfying the general requirements for city betterment and meeting the exigencies of each local situation. In the crucial attempts being made to lift the nation out of its economic chaos, the means employed will be concentrated to a considerable extent in the municipalities. Fresh opportunities and increased responsibilities are thus brought to the municipal engineer. The most insistent demand is for improvement in housing. As housing is a basic element in the structure of the city the committee believes the society should seize the opportunity presented by the better housing movement to attain its proper place in the city planning affairs of the nation. Adoption in principle of the thirty recommendations of the President's Conference Committee on City Planning and Zoning was effected as an outline of suitable objectives. Further, a research bureau was requested to cooperate in the research work recommended by the President's Conference Committee. Ways and means are to be determined to control more effectively the extent of municipal growth and to arouse public and official interest to the need for a systematic education in the knowledge of the benefits of city planning.

Other matters covered by the remaining papers in city planning were control of subdivision layout, growth control, economy of program and city planning and zoning as a means to better housing.

Last year Perry A. Fellows, engineer-manager, Detroit city airport, presented an exhaustive report on general principles of airport practice. This report has been in great demand all over the world. This year a brief survey of a limited field was presented covering such subjects as research, personnel, factors determining site location, size and rating, buildings and budgets.

Almost no new airports have been built during the last two years, said W. W. Horner, civil engineer, St. Louis, in his paper on airport drainage. The most notable feature observed is the difficulty with porous fills which are placed over the surface and become clogged unless a heavy turf can be maintained adjacent to the intercepting drains. Inlet gratings have now been installed to replace the porous fills. Not enough experience is available yet to codify a satisfactory set of drainage rules, but Mr. Horner gave a number of tentative rules for various types of soil and topography.

Surveying

Three papers on municipal field engineering and a report of investigations were presented by the committee on city surveying, the youngest of the society. Walter Starkweather, Detroit, chairman of the committee, in the first report, presented in convenient form information on matters of daily procedure considered good practice, avoiding emphasis on the fine technical points of highly specialized work that appeal only to the engineer of the larger metropolis. Topics covered specifically included surveys for street and alley openings; street widening; mapping from aerial mapping; signals; improvements in municipal surveying instruments for routine work; improvements in transportation of field parties and equip-

ment; surveys for vacation, dedication and condemnation of property; monumenting city limits; section corners and harbor lines.

In the paper on "Recent Developments in Instruments," by H. M. Dibert, secretary and treasurer, W. & L. E. Gurley, Troy, N. Y., a summary was given of changes effected in modern equipment of the surveyor due to more accurate manufacturing equipment, better materials to increase strength and durability, availability of modern alloys, platinum wire to replace the time-honored spider web, interchangeability. Because real property has increased 250 per cent in value since 1900, a great impetus has been given to better surveys and full mapping of the country. A higher order of surveying and instruments is essential. The most fertile source of suggestions for advance is the progressive field engineer, Mr. Dibert said, but it has been found that many of his suggestions have no universal applications and are not adaptable to manufacturing.

Water, sewage and garbage

Recent progress in satisfying the demand for a soft, pure, sparkling, odorless and tasteless water was given in the report of L. R. Howson, Chicago, Ill., chairman of the committee on waterworks. With reference to activated carbon he said that more than 400 plants use it, 30 per cent of them continuously. Requirements are usually 10 to 30 lb. per m.g.d. but dosages as high as 200 lb. have been used for short times. Aeration, the report states, is decreasing in use with the development of the more positive chemical methods of odor removal. More than 175 city plants now soften the supply. A recent survey reports the soap cost at $1 per capita per year for each 150 p.p.m. of hardness. The saving in soap alone usually justifies softening.

A. P. Learned, Kansas City, Mo., chairman of the committee on sewage and sanitation, presented an exhaustive report on recent developments, present status and plans for future development. In it were given the results of a questionnaire on sewer design practice and sewage disposal, and special articles on sludge dewatering and chemical precipitation.

"Sewage Disposal Costs," a paper by S. A. Greeley, Chicago, urged a method of stating the construction costs by cost per unit of volume or capacity of structures rather than by dollars per capita or per million gallons daily. He gave for an aeration plant the following structures: primary settling tanks, aeration tanks, operating galleries, final settling tanks, blower building and equipment, administration building, sludge-handling plant, outside piping, miscellaneous items such as water supply, roads and landscaping, engineering and contingencies, and land. For primary settling tanks the cost per cubic foot of effective volume was given as 54c. at Grand Rapids, 60c. at Peoria and 42c. at Rockford. The same unit for aeration tanks costs 29c. at Peoria. An acre-foot of trickling filter costs $11,670 at Akron and $14,267 at Hindsdale, Ill. Final settling tanks at Peoria cost 38c. per cubic foot, at Akron 66c. and at Hinsdale 35c. Digestion tanks at Grand Rapids cost 44c. per cubic foot, at Peoria 30c., and at Rockford 27c. Sludge drying beds at Grand Rapids cost 38c. per square foot, at Peoria, 38c., at Akron 72c., at Hinsdale 64c. and at Rockford 29c. Other items, like operating galleries, are estimated on the rated daily capacity per million gallons.

Harry M. Beaumont, Philadelphia, in his paper on "Operation of Sewage-Treatment Works" gave detailed instructions on how to handle each separate unit from screens to sludge. "The Causes of Structural Failures in Sewers," a paper by Dean Anson Marston and Prof. M. G. Spangler, both of Iowa State College, described the Marston theory of loads on conduits and how to design for these loads rationally for definite classification of field construction, particularly as to bedding and trenching methods.

A report giving progress during the year in refuse disposal and street cleaning and three papers on incinerators comprised the discussion on garbage and refuse. George B. Gascoigne, Cleveland, Ohio, chairman of the committee, gave the results of an exhaustive investigation in which a general survey of the field was undertaken. Reductions in cost have been effected by wage cuts, stagger employment, speeding up, increased mechanization and by decreased service. It has been contended in some quarters that refuse collection and disposal are not essential functions of government but services of convenience and economy. Incineration of wastes and sludge at sewage plants is increasing. About 3,000 tons capacity of refuse in 18 incinerators has been built. Material progress has been made in standardizing records. Cost data are still to be used cautiously, with recognition of their limitations.

J. S. Osborn, of the C. O. Bartlett and Snow Co., described the various methods by which cities buy incinerators, for which $24,000,000 has been spent in the last ten years. He seemed to favor the New Orleans method over that of Washington, where engineers designed everything. Carl Schneider, New Orleans, in his discussion indicated a preference for the Washington procedure. Two fundamental factors, patents and guarantees, he said, deter true competition and have materially delayed improvements by virtue of the penalty against improvement set up by the limited competition which they permit. Patents cover a small part of the plant and cities seem to require stricter guarantees than they do in other municipal works.

"Incinerator Firing Methods at Washington," a paper by Harrison P. Eddy, Jr., Boston, referring to the new rubbish incinerator at the national capital, discussed personnel, normal stoking and special stoking methods, air control, uniform feeding to hold a uniform heat, clinkers and the unusual materials burned, such as worn-out money from the Treasury Department and blotting paper from the postage-stamp printing presses. Records indicates that the fuel (rubbish) weighs 241 and 283 lb. per cubic yard at the Georgetown and O St. plants, respectively. Unit costs are $0.88 and $1.29 per ton for labor, $0.15 and $0.08 for water, $0.10 for electricity, and total $1.13 and $1.47, respectively. Georgetown operates at full and uniform capacity, O St. at varying capacity, averaging at half of full load.

Streets and traffic

In response to a widespread postcard questionnaire to members and numerous non-member city engineers on roadway widths, crowns, curb radii, grades, paving materials, bases and other street-design factors, 45 cities supplied information that was analysed by P. L. Brockway, Wichita, Kan., chairman of the committee on street design. Traffic lanes generally are 10 ft. wide and parking lanes 8 ft., figures that the committee feels can now be accepted without question as standard practice. A 5-ft. width of sidewalk in residential districts is most common. Crowns range from 0.01 to 0.014 of the width. Radii of curbs are increasing, with the present range from 8 to 15 ft. Grades are least standardized of any factor, conforming to topography and ranging from a minimum that is just enough to allow drainage up to a maximum of 20 per cent in residential streets and 6, 8 or even 10 per cent in business streets. No uniformity as to types of pavement was reported. Only one city reported a low-type surfacing for residential streets, a mixed-in-place oil and gravel.

A study of changes in concrete paving mixes and specifications shows steady advance in details, said E. K. Smith, of the Portland Cement Association, in his paper on trends. Concrete is now required to be denser, and 11 per cent of 63 new specifications examined require richer mixes. Many of the cities design by the water-cement-ratio method. Proportioning by weight has increased in favor. A majority of the cities attempt to ascertain strength by cores or cast specimens. Definite sign of change is lacking in the use of tamping. Half the cities require longitudinal floats, and 68 per cent require or permit finishing machines. Half use reinforcement. Longitudinal joints are standard, but only one-fourth use contraction joints, though expansion joints are standard. In 1932, 40 per cent provided for high- early-strength cement where justified.

Many municipalities in these days of restricted budgets are cutting off street lamps as an economy measure. The committee on street and traffic lighting, headed by Ellsworth Francisco, Newark, N. J., devoted its whole report to demonstrating that it is false economy to cut down illumination. The increase in accidents, fatal and otherwise, as well as increased burglary losses far exceeds any saving effected by reducing the light bill. In the opinion of the committee few if any existing system of illlumination can be classed as extravagant or wasteful. In fact the average system is less than half adequate now. Whenever cut it has produced a sharp increase in accidents and crime. Street-lighting experts agree that adequate lighting should cost $2.50 per capita, whereas the average is $1.19. Doubling the cost, it is estimated, would save the public purse $350,000,000 annually based on 1931.

Burton Marsh, Philadelphia, Pa., in his report as chairman of the traffic control committee (read by Maxwell Halsey) laid a new responsibility on the municipal engineer, that of solving the traffic problem, since a large part of the problem is essentially engineering in character. He indicated that engineers had not assumed control of the problem in most cities and urged them to do so regardless of the lack of a proper administrative organization. Recommendations to the society to push traffic engineering by publicity and otherwise were looked upon favorably by the board of directors.

Legislation and finance

In the report of the committee on public utilities, Gerald J. Wagner, Grand Rapids, Mich., chairman, made a strenuous appeal for cities to put their water, sewer and other utilities on a self-liquidating basis so that they may obtain loans from the R.F.C. Liberalization of the Relief Act was recommended to make more projects eligible for financing. State laws to put sewage plants on the service-charge basis were recommended. At two-part rate, combining a service-demand charge and a consumption charge representing operating expense, was suggested as equitable.

The committee on municipal legislation and finance, C. A. Howland, Philadelphia, chairman, reported on a questionnaire which resulted in 54 answers. Some of the conclusions indicated are that an opportunity exists for the society to suggest principles of procedure in carrying out special assessments for street construction and sewers.

For the ensuing year (to the fall meeting) the following officers were named: president, Samuel A. Greeley; vice-presidents, C. M. Reppert, Harrison P. Eddy, Jr., and Bryson Vallas; treasurer, H. Shifrin. The board re-elected C. W. S. Sammelman, St. Louis, executive director.

Construction League Asks Work for Relief

AT THE meeting of the Construction League of the United States at Detroit on Jan. 21 a strongly worded resolution was adopted on motion of the chairman, Robert D. Kohn, demanding full utilization of work for relief of unemployment and asserting that the present situation calls for the most energetic measures in dealing with it. The resolution is reproduced in full text below.

Definite progress was made by the league at this, its second annual meeting, in developing its organization and program. It adhered to the purpose of dealing with internal problems of the construction industry only. However, it authorized its chairman to select emergency contacts in all component groups for immediate service in any emergencies that may develop in the course of the next few months with respect to national action. One possibility that is now thought to be in prospect is the initiation of some form of national construction planning.

An address by J. P. Hallihan on engineering economics pointed to the present difficulties in promoting employment through public-works construction because of the lack of antecedent planning. As vice-chairman of the Michigan Committee for Trade Recovery, Major Hallihan has recently had much personal experience with these difficulties. Planning in the field of private enterprise was discussed by Leonard Reaume, of the real estate department of the Detroit Trust Co., who spoke of the potential need for construction caused by obsolescence. The deterioration and decline of value in the inner sections of cities give occasion for extensive work in rehabilitating and modernizing buildings, some of which has been done in Detroit with favorable financial results. For best effect in stabilizing city conditions and values, however, such work needs to be done on a community planning basis. Mr. Reaume suggested a system under which, with the aid of suitable legislation, four-fifths of the owners in a block (or preferably in an entire school district) would merge in a corporation and be given the right of condemnation in order to rehabilitate and develop the whole area on a stable basis.

Mr. Reaume also showed that Detroit is not overbuilt; it had no more surplus of housing facilities in 1930 than in 1915, which latter was not a year of surplus. The next ten years, in his opinion, will be a big period of reconstruction. With neighborhood control, sound construction and proper long-time financing, we will be able to rebuild the centers of our cities.

The league considered the Relief Act with respect to amendments necessary in order to make Title II, on financial aid for municipal works, effective; it approved the amendments adopted by the American Society of Civil Engineers (*ENR*, Jan. 19, 1933, p. 98). It also voted in favor of the principle of consolidating federal public-works operations, and requested its constituent organizations to urge upon Congress the appointment of standing committees on construction.

The formation of the National Committee for Trade Recovery under the auspices of the league was reported, and George T. Seabury, secretary of the American Society of Civil Engineers, gave an enthusiastic report on its activities since last May.

Discussing the code of practice for the construction industry, which has been under consideration during the past year, the league expressed itself as favoring a code framed with a view to self-regulation rather than to enforcement by the Federal Trade Commission. It also authorized the drafting of practice codes for subcontractors. Bid shopping, single-price bidding and gas-tax diversion were also discussed by the meeting.

A. J. Hammond, president of the American Society of Civil Engineers, was elected vice-chairman of the league. It is planned to hold the next meeting of the policy committee at Chicago on June 29.

LEAGUE URGES WORK INSTEAD OF CHARITY

"THE Construction League of the United States, meeting in assembly at Detroit, Jan. 21, 1933, expresses its grave concern at the effects of growing unemployment on private and public welfare. It finds that, despite the appalling human and economic waste resulting from this condition, chief dependence is being placed on direct relief measures. In consequence there is a progressive loss of morale, which constitutes a threat to the future of our country.

"In view of the urgency of this situation the Construction League appeals to every department of government, business and industry to organize cooperation in planning to restore the unemployed to useful employment, in recognition of the fact that no progress toward recovery can be expected until men are put to work. Planned effort is essential because the surplus of workers will exist for a number of years.

"The league further points out that the industries that produce consumption goods cannot now or for some time to come absorb additional labor, while on the other hand there exists throughout the nation a clear need for new and improved public service facilities. It therefore urges that the surplus manpower be utilized as far as practicable in creating employment through public works, the rehabilitation of blighted areas, and the construction of decent housing for the low-income groups, all of these to be based on long-term planning so as to provide for the necessities and amenities of the better life both inside and outside of our towns and cities"

Materials Producers Talk of Markets and Technology

Paving brick, sand and gravel, crushed stone and ready-mixed concrete assume active roles in the discussions of the highway and construction congress

THE GROWING prominence of associations of materials producers as deliberative technical bodies was fully maintained in the discussions of the four leading groups taking part in the highway and building congress. In emerging from a year of greatly curtailed operations emphasis of the subject of markets was natural, but it did not cause a cessation of interest in technological development nor in invention of new products. Not only were these advances prominently placed in the program of papers and discussions, but future lines of research were given consideration. Underlying all there was an evident disposition disclosed to cooperate fully in the purposes of the congress—to bring about united action, to promote construction, and to prevent further diversion of construction funds from work relief to direct-relief doles.

National Paving Brick Assocation

NEW technical investigations, particularly affecting fillers and reinforced-brick reconstruction, were outstanding features of the annual meeting of the National Paving Brick Association. Because of the trend to non-skid surfaces in the building of low-cost roads, the opening paper, "Research Applied to Brick Pavements," read by John S. Crandell, professor of highway engineering, University of Illinois, was particularly apt. Some of his conclusions follow:

Lug brick allows plenty of filler to flow into the joints; lugless brick keeps it out. Accelerated tests made on a joint filler, presumed to be rubber, revealed that the filler had no rubber content and that this filler lost its quality of adhesion and became brittle at freezing temperatures. The mineral content of certain mastic fillers settles to the bottom of the joint, allowing almost pure bitumen to flow out of the joints on the first hot day after pouring.

Tests on a number of standard state highway fillers revealed the fact that all were brittle at 32 deg. F. Three samples were not brittle, but they were not highway specification standards, two of them containing rubber and the third pulverized asphalt softened with maltha.

Mr. Crandell reported that one of his students had developed a filler that is an admixture of rubber and asphalt. Tests on this and other rubber admixtures lead Mr. Crandell to believe that the answer to the successful filler is rubber. To prevent slipperiness on brick pavements, Mr. Crandell recommended that the surface be sprayed with kerosene, and when the film had softened that sand or pea gravel be spread on, using about 15 lb. per sq.yd. Softening can be accomplished also with surface heaters, though it is expensive.

Several interesting features of construction were brought out in a paper read by O. W. Merrell, director of highways of Ohio, describing practice on recently laid brick pavements. On one road job near Columbus a mastic cushion was used. This cushion material was made in a pug-mill plant by a manufacturer of cold-mix bituminous concrete products. Limestone, sand or grit, dried and cooled overnight, was mixed in the following proportions, by weight: sand, 94.7 per cent; mastic, 4.3 per cent; liquefier, 1 per cent. Though there was apprehension that that portion of the cushion not spread and covered might set overnight, this proved not to be the case. However, no rolling or preliminary compaction should be allowed, and the material should be placed and shaped with the least manipulation or reshaping.

Mr. Merrell reported that, in an effort to avoid slipperiness resulting from bituminous fillers, cement-grout filler was tried on several experimental projects. One mile of a 5.45-mile road was used for experiments with various kinds of filler and cushion, the rest of the road being filled with the standard asphalt filler. The base is 7-in. concrete of a 1:7½ mix, with thickened edges and contraction joints every 50 ft. Cement-lime-sand grout of 1:1:3 mixes was used, and throughout both sections ½-in. expansion joints were inserted between roadway and curb and at the center line. Under other grout-filled sections the center joint was omitted. A limited amount of mastic cushion was used under both asphalt-filled and grout-filled sections.

Temperature-resisting cement is being tried out for use in the grout. The cement contains about 4½ per cent powdered asphalt. In mixing the grout, even with a one-sack mixer, difficulty was met in getting a homogeneous mixture. Observations made on the road after it had been open some time showed that some joint filler could be removed with a pen-knife, indicating, doubtless, that the mixing had not been thorough enough.

Most important of the Ohio experiments, says Mr. Merrell, is the removal of surplus filler during construction. Bricks are first coated with either whitewash, calcium chloride in solution or a patented mixture known as B & B. On one job whitewash was used in the proportions of 1½ sacks of spraying lime to 50 gal. of water and sprayed with a hand-operated pressure tank just enough to produce a fog that would settle easily on the brick faces but not the sides. Asphalt filler was applied from coal scuttles, and the entire surface was coated ⅛ to ¼ in. Before the filler became cool it was rolled back, having first been cut into strips 2 ft. wide. The only difficulty encountered in this method lies in the fact that the recovered filler is hard to free of the foreign particles that it inevitably picks up when rolled back.

Several advantages for flexible bases for brick pavements were claimed by John H. Lowe, county engineer of Dougherty County, Ga. These are: They present surfaces which ease the shock to both vehicle and passenger and have enough resiliency to assume their normal position after distortion; repairs, in case of foundation failure, are easier and cheaper; repairs are speedy; the original cost is low; most types resist water infiltration or through capillarity because fewer cracks occur; frost-heave dangers are minimized.

Through studies of local materials Mr. Lowe has found a sand-clay base suitable in his locality. In building a particular 5-mile section of this type, the road was not closed. All fills were laid in 18-in. lifts, materials being hauled over freshly placed fills. The top 2 ft. of all fills was composed of selected materials. Doubtful base material in all cuts was removed. On top of the sand-clay base a tar prime coat was laid. Upon this was placed the ¾-in. sand cushion. Asphalt filler of 30-40 penetration was used. The road is 18 ft. wide, and bricks are laid between 5x12-in. headers. Tests on subgrade materials showed that a mixture containing from 10 to 13 per cent of clay was best. This road, Mr. Lowe reported, has been in use about a year, and so far no failures have been detected.

"This affiliation with so-called competitive interests in a joint endeavor to solve problems common to all participating interests is a step in the right direction."

O. W. RENKERT,
President, National Paving Brick Assn.

The practical economy of resurfacing old pavements with brick was described by Morgan P. O'Brien, of Springfield, Ill. Some of the old street was of the two-course type, other and later projects employing a concrete base. The old surfacing was of hard-burned brick set on edge, a sand filler being used throughout. Cost of preparing the old surface to its new grade, which included removal of brick where service cuts had depressed the road, removal of sand filler ¼ in. below the surface, widening of the road 8 ft. and the placing of concrete slabs in the widened section, was approximately 3c. a square yard. The new brick surface was laid on a 1-in. mastic cushion, and the 2½-in. bricks were filled with an asphalt filler. One advantage of reconstruction that can be accomplished so quickly, Mr. O'Brien pointed out, lies in the fact that business concerns or industrial plants fronting such improvements lose little time compared to the loss—at times almost equal to the cost of reconstruction—that they would sustain were the street to be entirely reconstructed.

National Crushed Stone Association

DISCUSSIONS of the need for extended research, particularly because of the present trend toward low-cost roads, of how modification of the anti-trust laws can be attained in order better to balance production with consumption, and of what can be done immediately to stop gasoline-tax diversion were outstanding at the convention of the National Crushed Stone Association. Running through the proceedings, however, was the expressed belief that individual competitive problems should be submerged in a cooperative effort with other producing groups to stimulate construction of no matter what nature.

In opening the general sessions Maurice Holland, director of the division of engineering and industrial research of the National Research Council, urged that now, more than ever, research was needed and that a balanced study of economic and scientific data would yield from a 5 to 1 to a 10 to 1 return on whatever investment was made upon it. Proceeding from a general discussion of the value of research to a specific one, he outlined what could immediately be done—studies in surface texture, porosity, crystalline structure, etc., and the effect of these upon concrete. As another line of research, he suggested an investigation of testing methods, of the concrete-making qualities of various stones, with particular reference to their use in low-cost roads.

Low-cost road construction had a conspicuous place on the program and was treated in two papers: "The Cement-Bound Macadam Road," by E. M. Fleming, manager of the highways and municipal bureau of the Portland Cement Association, and "The Use of Crushed Stone for Widening Highways," by Fred Swineford, chief engineer of the Ohio Crushed Stone Association. Mr. Fleming said that the market for the cement-bound macadam road and similar types was in the neighborhood of 400,000 miles. This road, an experimental length about a mile long, was described in *Engineering News-Record*, Oct. 13, 1932, p. 437.

In opening the discussion of Mr. Fleming's paper J. H. Bixby, district engineer of the New York state highway department, departed from the subject long enough to urge that gasoline-tax diversion be attacked through local communities. Since more low-cost roads were being built than any other kind, he suggested that communities benefited by proposed improvements be told that road construction would mean the employment of local labor. He would make the requirements for the ues of local labor on low-cost construction even more stringent than those imposed by the government on the construction of federal-aid highways.

Further discussion of Mr. Fleming's paper brought out a description of the sandwich-type, bituminous-coated, slow-setting cement highways recently tried in Massachusetts. H. O. Pearson, of F. T. Ley & Co., Springfield, Mass., described that experimental length which, with welfare labor, cost $1 a yard exclusive of subgrade preparation.

Mr. Swineford's paper, while referring primarly to widening, also pointed out the possibilities of retreading worn-out roads with bituminous-bound stone. Markets for the use of stone outside of new construction lay, he said, in building waterbound shoulders, in widening and superelevating curves, in applying bituminous non-skid surfacing to old highways, and in improving shoulders to safeguard automobilists and to provide parking off the main road.

There can be no relief from the present situation of uncontrolled production that has resulted in demoralized prices until the anti-trust laws are modified, Gilbert H. Montague, New York City attorney, told members of the association. He said that Congress so far had been unimpressed by proposed acts, framed largely by inconspicuous lawyers urged to do so by individual firms. That the anti-trust laws had not been modified was the fault of business for not presenting a unified demand that they be relaxed. The form of statute, he said, might be patterned after procedure established in some states for the control of oil production, whereby commissions limit the amount each well shall yield when production exceeds the consumption and facilities that are present for distribution.

"We believe that the values of this foregathering . . . also exist in the potential power which lies in concerted action for the benefit not only of the construction industries themselves but for the welfare of the entire nation."

OTHO M. GRAVES,
President, National Crushed Stone Assn.

In a joint session with the members of the National Sand and Gravel Association the crushed-stone producers listened to a talk by J. M. Fitzgerald, vice-chairman of the committee on public relations of the eastern railroads, and then proceeded to a joint discussion of wayside-plant competition. Mr. Fitzgerald maintained that if federal regulation is sound for railroads, it is just as sound for motor transportation, and decried the fact that, though railroads were supervised as to rates, new lines, abandonment, financial loans, wages, hours of service and all safety features, motor transport had only limited state control.

A. T. Goldbeck, director of the bureau of engineering of the National Crushed Stone Association, opened the discussion of wayside plants, pointing out the fact that, though there was a legitimate use for such plants at times, the drift toward low-cost highways might easily lead to their abuse. He recommended, as ways to combat such harmful competition, adjustment of freight rates which often shut out the commercial aggregate producer. The insistence that specifications be identical for wayside plants and commercial producers, that the enforcement of specifications be equally rigid, decentralization of plants, rigid, re-inspection provisions and the addition to central plants of semi-portable ones.

Stanton Walker, discussing the subject for the gravel producers, recommended that some provision be included in the specifications which would provide for the submission of test samples within five days after the opening of bids and that the bidder submit a statement of sources of his aggregates. In discussion, the Missouri plan was described. This is a plan whereby the state agrees to buy all of its aggregate, and to ship by rail in about 65 per cent of the state. The agreement was arrived at through the cooperation of aggregate producers, the railroads (who made certain rate reductions) and the state highway department. The railroads made a reduction of 20 per cent on their single and joint-line scales.

Thomas E. Wright, executive secretary of the N. Y. State Construction Council, presented the case against diversion of gasoline taxes. He asserted that New York State, in 1932, lost $51,000,000 of the $93,000,000 paid into the state treasury from gas tax and license fee incomes. Even with a 2c. gasoline

tax, the income from this and motor-vehicle licenses amounts to $72,000,000, considered ample for new construction and maintenance requirements. Mr. Wright was emphatic in saying that motorists can afford to pay user taxes only so long as the money is spent for road betterment, that continued diversion would destroy highway progress, that tax money used in new construction will ultimately greatly decrease the maintenance bill which, without new construction, becomes greater and more burdensome. Mr. Wright said that of the $51,000,000 that was diverted in 1932, $41,000,000 would have gone to labor in one way or another, furnishing jobs for 78,000 men for 200 working days, or support to a population of 300,000 for a year.

Sand and Gravel Association

PRACTICALLY the same problems that face the members of the National Crushed Stone Association confront the members of the National Sand and Gravel Association, though at the annual meeting of the latter body additional facts worth noting were brought out. The sessions opened with semi-confidential reports of conditions in the industry described by producers from all over the country. In summary, these conclusions were reached: that sharp competition has brought producers' costs down and greatly improved their operations; that there is a substantial decrease in business over 1931, but a greater determination to talk things over with competitors with a view to more stabilization than now exists; that there is a trend toward the medium-sized plant; and that something must be done to relax the federal anti-trust laws.

Strong evidence of the value to aggregate producers of emergency highway construction was the report of one of them that practically his entire $300,000 1932 payroll was supplied through that means and regular highway construction.

Because it is upon the states that highway construction industries largely depend for funds, the executive secretary of the association, V. P. Ahearn, strongly urged that the sand and gravel producers join with other industries not only in combatting gasoline-tax diversion, but the well-organized "propaganda . . . for discrediting highway construction." He asserted that this propaganda, well financed and skillfully engineered, was directed against road building on the claims that it does not possess the utility claimed for it in providing employment, that the present plight of many states is due to "unbearable burdens arising from highway programs of the past ten years, and 'because we have too many roads anyhow.'"

To refute this, Mr. Ahearn quoted figures supplied by G. C. Dillmann, state highway engineer of Michigan, to the effect that one-fourth of the country's 74,500 unimproved miles on state roads could be immediately constructed and justified economically. The same thing would be true of 50,000 miles of state roads needing reconstruction, of paving 22,000 miles of the 2,204,566 miles of unimproved county and township roads, and of surfacing and improving a reasonable per cent of the remainder. Such a program of construction would cost around $4,000,000,000, "which could well be spent on the county and township roads over three years without carrying out more than a conservative and badly needed program."

"The Congress has afforded the sand and gravel industry an opportunity to realize that it is a force in an integrated construction industry.

H. B. OWENS,
President, National Sand and Gravel Assn.

There was considerable additional discussion on where one might look for business this year. A paper on "Prospects for a Ballast Market for 1933," read by H. R. Clarke, engineer, maintenance-of-way, C.B.&Q. system, revealed that there would be very little increased ballasting until there is an increase in railroad earnings, that, because of decreased traffic, average maintenance requirements had been cut about 25 per cent, and that last year about 33 per cent of maintenance requirements (based on 100 per cent traffic) were fulfilled.

In presenting "Marketing Problems in the Sand and Gravel Industry," Mr. Ahearn discussed the possibility of sales companies patterned after those on trial in the soft-coal field. He made the assertion that mergers, of which there had been many in the industry, stood the best chance of success in those cases where there was a consolidation of operations without one of financial structure. Where both functions were merged, the united organization became so top-heavy that competition was invited, and usually accepted the invitation, thus producing capacity far beyond the needs of consumption. Could there be an interchange of equipment among producers, Mr. Ahearn believed there could be a much better-balanced production.

Emphasis was placed by the sand and gravel producers upon the need for some relaxation in the anti-trust laws. William P. Belden, Cleveland, and a member of the commerce committee of the American Bar Association, prepared a paper that was read by one of his associates in which Mr. Belden sought support for the bill now being prepared by his committee. This bill would seek to enlarge the powers of the Federal Trade Commission, allowing two or more producers or manufacturers to enter into a trade agreement for a probationary period. Should objection be made to the agreement, the Federal Trade Commission would take the testimony from both sides. If the testimony revealed unreasonable restraint of trade, a dissolution of the agreement would be ordered; if not, the agreement would be allowed to stand. The proposed bill would not apply to railroads, water carriers or agriculture. In effect, such a bill substitutes the business judgment of the Federal Trade Commission for "legal barriers which have served their purpose." It was generally agreed that support of such a measure would go much farther toward the alleviation of the price situation than were any industry or group of industries to foster a separate measure.

Ready-Mixed Concrete Association

ALTHOUGH there was a sharp decline in the use of concrete in 1932 over 1931, ready-mixed concrete gained in percentage of total concrete placed. This fact was attested by several members during the sessions of the Ready-Mixed Concrete Association. Despite its showing as compared with job-placed concrete, the industry, it was emphasized, must be reconciled with lower tonnages this year.

That the industry is vitally concerned with economic as well as engineering and ethical problems was stressed throughout the discussions and in the executive staff report. From that report the following is quoted:

"Questionnaires were sent to 300 . . . companies. Sixty-eight companies responded . . . Suggestive of the type of information available as a result of the returns from the questionnaire are facts concerning population within economical haul of ready-mixed concrete plants; daily capacity for different types of plants; investment in the industry; sizes of central and truck mixers; normal operating forces; number and capacity of trucks." The report emphasized the fact that the ready-mixed concrete industry should profit by the economic mistakes of older industries and should lean as heavily upon economic research as upon engineering investigation.

"The Congress has demonstrated in a forceful manner the necessity of the construction industry addressing the public as a co-ordinated group."

H. F. THOMSON,
President, Ready-Mixed Concrete Assn.

Further data on "How and where is business?" were contained in five-minute reports at a semi-executive session, only the broad conclusions of which can here be set forth. There was general agreement that demoralization of aggregate prices had imposed heavy penalties on price stabilization; that a fairer spread between materials' costs and product had to be secured; that strength specifications prevailed in the larger communities and volume proportioning in the smaller ones; that experience showed central mixing with dump trucks and a stiff mix was economical on short hauls, and central mixing and agitators with wetter mixes on longer hauls; and that there was a growing demand for ready-mixed concrete by municipalities for patching, trenching and even sidewalk construction, which for so long has resisted anything but two-course work.

Of particular interest from the technical side was the presentation of a purchase specification by R. B. Young, consulting engineer of Toronto. It offered five bases upon which quality was to be determined—volume of ingredients, weight, amount of cement per unit of volume of concrete, water ratio or strength specification. The purchase specification provides a time limit for mixing in agitators, maximum and minimum time limits for mixing in truck mixers at various speeds, and it definitely outlines strength specification requirements. One of these provisions is that 90 per cent of all specimens must have a strength equal to or greater than the specified strength. No job-stored specimens will be recognized for testing. If specimens do not meet the above strength requirements, core borings not over 60 days old should be taken and tested under saturated conditions. No penalty for sub-standard cores has yet been fixed in the specification.

Another important feature of the purchase specification is that the volume measurement of concrete shall be the volume as delivered, and not that which is measured in the forms. The specification also would include an alternate strength clause, whereby the purchaser could, if he wished, waive all quality requirements if he believed the producer's past performance justified such a waiver.

There was considerable discussion on a paper "Use of Ready-Mixed Concrete in Cold Weather," by Miles N. Clair, Thompson & Lichtner Co., Boston. However, it was agreed that greater study should be given to local climatic conditions and that there probably would come a time when central-mixing plants would have to have modern means for heating enough aggregates and storing under cover for at least an average day's supply. Other equipment needs, it was pointed out, included lighter or entirely new conveying devices for distribution at the point of use.

Work-Relief Plans Stressed by General Contractors

Wide range of papers on finance, taxation, government competition, modernizing and work sharing have underlying theme of unemployment relief through construction

WORK RELIEF was the underlying theme of the papers and discussion by the Associated General Contractors at the highway and building congress. With a year's record of regular operating routine and a special drive for federal legislation behind it, the association struck vigorously into a program for work relief and a unified construction industry. Work relief was considered as it might be influenced by reformed financing and removal of government competition by day labor and as it might be provided by modernization campaigns and by share-the-work activities.

Modernizing activities

How Portland, Ore., by a city-wide campaign created a retail market for construction for which no wholesale market existed, was explained by Geo. B. Herington, consulting engineer. With the backing of prominent business men and the cooperation of the newspapers, a civil engineering committee was organized to register the city's unemployed and make a house-to-house canvass of the property owners to discuss opportunities for modernization and reconstruction work. Wide publicity was given to the fact that repairs and reconstruction work can be had at bargain prices 25 to 50 per cent lower than those of former years. The city was divided into districts, and organized crews of solicitors secured pledges of work costing $10,200,000. The types of jobs uncovered included plumbing, roofing, electric wiring, carpentry, sidewalk construction, painting and garage construction.

Coining the word "renovise," the construction and business interests of Philadelphia started a "Renovise Philadelphia" campaign, with a goal of developing repairs and reconstruction amounting to $15,000,000. Success has now led to advancing this goal to $25,000,000, and a total approaching this figure seems possible. The method of conducting the campaign, as outlined by A. E. Horst, general contractor, chairman of the construction committee of the campaign organization, was briefly as follows:

The metropolitan district of Phiadelphia was subdivided into geographic divisions to which technically trained groups of volunteer solicitors coming from the membership of interested civic and trade organizations have been assigned for a house-to-house canvass.

The home owner or mortgagee is asked to indicate on a signed pledge card the amount of money which he reasonably believes he can spend in repairing and modernizing his home or business property. The pledges of work to be done and money to be expended are for specific items and in specific amounts.

The property owner or mortgagee is urged to have the work done through contracting firms from his neighborhood.

To aid the property owner in the solution of his particular problem, there has been set up an architecture and engineering bureau to give preliminary architectural and engineering advice and to assemble exhibits to assist home owners and others to visualize modern building methods, as well as a construction bureau to give advice on estimates and letting of contracts. This advice definitely is of a preliminary nature and only for the purpose of enabling the property owner to reach a decision to proceed with the work. It does not include plans, working drawings and specifications, and therefore does not interfere with the regular services of the architect and engineer.

Discussion brought out from both Mr. Herington and Mr. Horst the information that funds for the work described had come from current earnings and previous savings of the owners. The banks had not in general been inclined to make loans for these investments.

Relief from government competition

Second among means of work relief on which specific data were presented was a record presented by Joseph B. Shannon, member of Congress, of a study of federal departments engaged in construction in competition with contractors in private practice. A committee of Congress headed by Mr. Shannon had required reports from 27 departments and agencies that have construction expenditures. The inquiry covered the fiscal year ending June 30, 1932, and disclosed 66 per cent construction by contracts and 34 per cent by day labor.

While the reports show that it was impracticable under some circumstance to perform certain kinds of mainte-

nance, repairs and alterations by the contract method, simply because conditions would not permit the preparation of definite plans and specifications and the taking of competitive bids, and while many agencies performed nearly 100 per cent of both their construction and maintenance by contract, others performed almost 100 per cent with their own forces.

An analysis of the answers received would seem to indicate that the ownership of a large amount of equipment is perhaps the greatest factor in keeping the government in the business of competition with private contractors.

The answers received from the 27 federal agencies doing building and engineering work to whom questionnaires were sent show the following interesting equipment figures:

Total of all work done during 1932, including all done by contracts or otherwise	$349,712,000
New equipment purchased during 1932	5,960,000
Equipment, repairs, etc., during 1932	8,436,000
Value of all equipment, plant, etc., at end of 1932	87,744,000

It was pointed out that relief lies in:

1. The enactment of laws: (*a*) setting up a limit on the size of projects which may be performed by government plant without specific appropriation therefore; (*b*) preventing the abuse of declaring an "emergency" and under this guise performing work with the government's own forces and without taking competitive bids.

2. The enactment of laws providing that specific appropriations must be made: (*a*) before pieces of construction equipment costing above a certain maximum, say $2,500, may be purchased; (*b*) where the expenditures in alterations or repairs on any piece of government equipment exceeds a certain maximum amount, say $5,000.

Possible financing relief

An unusual list of speakers from the banking and investment agencies had been selected to discuss the possibilities for work relief by revision of financing practices. These brought out few specific plans. Chiefly, the remarks outlined causes of the depression as being extravagance and overexpansion and read from them a lesson of frugality.

Albert J. Hettinger, president of the Investment Research Corp., of Detroit, after pointing out that the fluctuations in the yearly volume of construction far exceed those in consumer industries, expressed the belief that general business will not swing back to normal until an active market for construction is created. That time will not arrive, it was stated, until there is a bond market that will absorb new offerings at reasonable rates of interest. While there is at present an abundance of short-time credit seeking utilization, there is widespread timidity in putting funds to work on long-time commitments even though the banks at present have an excess of reserves. As a measure of returning general confidence, the federal government, Mr. Hettinger believed, must instill confidence in itself by reducing operating expenses, eliminating waste and relieving present burdens of taxation.

Calling attention to the staggering mortgage burden on the country, Fredrick A. Cranford, general contractor, urged that scaling down of interest rates was quite as obligatory as was tax reduction. Rates for this money hired in the past were out of focus with the present conditions and needed revision. Instances were cited where this had already been done. In brief, hired money had to take its cut under present conditions as had other kinds of earnings. Incidentally, he considered that R.F.C. loan rates must be drastically reduced.

Roadbuilding as work relief

The possibilities of roadbuilding as a means of work relief were considered in a series of four papers. Discussing hand labor on road work, C. M. Zeigler, deputy state highway commissioner of Michigan, stated: The advantages of roadbuilding as relief measures can be covered in a few items: (1) these funds, if so appropriated, can be immediately put to work; (2) construction of highways covers widespread work and therefore reaches into every section of the country; and (3) highways are a much needed capital asset of the United States and will show big dividends even in these times, and particularly so when more prosperous times return.

Commenting on the social and economic values of highways, R. L. Morrison, professor of highway engineering and highway transport, University of Michigan, stated that the present slogan seemed to be "Reduce taxes regardless of consequences." Tax reduction is desirable, but there is a joker about road taxes. That is that the greatest reduction can be obtained only by building more roads. This is because more can be saved by reducing the bad-roads taxes than by reducing the good-roads taxes.

"My good-roads taxes," Professor Morrison said, "were paid last year at the rate of 0.6c. per mile, but as soon as I drove off a pavement onto a gravel road, that gravel road collected a bad-road tax of 1c. per mile; and if I drove over an earth road, it collected a tax of 2c. per mile. The only way we can reduce the 1c. and 2c. per mile tax is by continuing the 0.6c. per mile tax and using all of it for roads. The economic benefit to me of highway improvement is primarily the reduction of my gasoline, tire and repair bills, and the same thing is true of the 26,000,000 other motor-vehicle owners."

If the improvement of any given highway will save more to the users annually in decreased operating costs than the annual costs for interest, depreciation and maintenance of the improvement, then true economy results from improving the highway and not from "saving" the cost of the improvement. It is only by the continued reduction of operating costs that the greatest economic benefits can be obtained.

Future possibilities in highway construction were reviewed by O. W. Merrell, director of highways of Ohio. Tracing progress in recent years, Mr. Merrell pointed out that the present depression is of necessity giving rise to numerous developments in the manufacture of motor vehicles, the effect of which will not be felt until we have returned to normalcy. The average man, forced to live on a limited income, is on the alert for small savings in the purchase and operation of his automobile and the tires and other accessories. The commercial hauler who was self-satisfied when he was making a reasonable profit at 10c. a ton-mile is casting about for ways and means of saving a few cents here and there in operating costs when forced to haul for 4 or 5c. This spirit is reflected throughout the entire automotive industry and among all the producers of accessories, lubricants and fuel.

These improvements in methods and material, brought about by the force of present circumstances, will not be forgotten when the need for such minor economies no longer exists. The result will be a vastly increased popularity of motor travel and transportation. Travel for pleasure will be cheaper, safer and pleasanter. Producers have gone farther and farther afield to find markets, which will mean a wider distribution of products. For these reasons and similar ones the statistics for the next twenty years will show the present depression to be a stimulant to motor travel and transportation. Some would advocate embarking upon a gigantic program of highway construction at the present time. This would be both impractical and impossible; impractical because we can only deal with the future in a general way, and many of the details of our construction would be obsolete when improved methods of motor transportation are developed; impossible, because the public will not and cannot stand for the increased expenditures at this time.

It is better for all concerned to go along with as nearly a normal highway program as possible, keeping the future in mind. The public will be more able and willing to pay when the need actually develops; the engineer will be in a better position to design that which is useful and necessary, and the mushroom contractor of the past two years will have returned to his legitimate field of endeavor, giving the honest road-builder an opportunity to give a real highway while making a reasonable profit.

American Society of Civil Engineers Holds Eightieth Annual Meeting

Eighth decade of activities ends with continued gain in membership despite business conditions—Important reports submitted by committees on steel-column research and windbracing of tall buildings

Engineering News-Record Staff Report

WITH a continued gain in "assets in men" and with many evidences of a continuing youthfulness of spirit in its approach to its many problems, the American Society of Civil Engineers closed the 80th year of its activities at its annual meeting in New York on Jan. 18-21 and began the work of the ninth decade of its existence. At the end of the eightieth year the society had a membership of 15,247, and its annual expenditures amounted to close to $350,000. Admissions to membership during the year totaled 736, but the net gain in membership amounted to only 57 due to large losses by death or through being dropped from the rolls. More than 1,200 members attended the annual meeting.

Financially the society reported that its income had fallen off $36,650, or 15.1 per cent from last year and that its expenses had been cut 16.7 per cent. Inability of many members to pay dues was one of the principal causes of this decline in income. At the end of the year the society was carrying more than 2,000 members in arrears of dues but otherwise in good standing, because the board of direction considers members with many years of service to the society as an asset not to be measured by ability to pay dues.

Long-range planning

The value and place of long-range planning was the subject of two important papers presented at the opening of the technical sessions by David Friday, economist, Washington, D. C., and Fred I. Kent, director, Bankers Trust Co. At the same session R. E. Dougherty, vice-president, New York Central Lines, spoke on the economic condition of the railroads of the country.

Little is to be expected in the way of concrete results from any planning or programming for general business at the bottom of a depression, said Mr. Friday, because such planning almost invariably calls for placing limitations upon the activities of many industries, and no one, as a practical matter, would think of keeping an industry from taking advantage of any opportunity for increased operations at such a time as this. The time for serious consideration of planned control of industry is when times begin to indicate that business is reaching a peak of prosperity.

The key to industrial stabilization, or better to "controlled change," Mr. Friday said, lies in the production of "durable goods." Production of such goods is off about 60 per cent as against only 30 per cent for "consumable goods." The construction industry is one of the large producers of durable goods, and it has been the hardest hit of all industries —as in all depressions, according to Mr. Friday.

Another lesson to be learned from the current depression is that our whole scheme of railway regulation has to be rewritten. It is now based on the control of railways as a monopoly, whereas the advent of the motor truck and bus has ended that monopoly.

Paying men to do nothing

The principal cause of our present economic depression is due to "paying men to do nothing," a process that started in Europe immediately following the war when European governments endeavored to carry their returned soldiers through the period of readjustment by unemployment insurance or by putting them on government payrolls dong no useful work. If the European governments had looked upon the war simply as an industrial holiday in which the losses of war had been offset by the young people coming to maturity, and if they had resumed industrial and commercial operations just as they are resumed after any normal holiday, the demoralization of business and industry would not have resulted. Mr. Kent would have us take similar action in regard to the current depression by having the federal government guarantee all industry against losses that it may incur through resuming normal production as of the years just prior to the depression. By resuming normal operations men would be put back to work, commerce would be revived, and Mr. Kent believes that in a short time the government would recoup any temporary losses by the restoration of normal business.

Navigable waterways

"Determination of the navigability of a waterway is never made by a governmental department by fiat," said Brig. Gen. G. B. Pillsbury, Assistant Chief of Engineers, speaking before the waterways division, "it is a matter of court determination upon assembled facts." Therefore, where there is any indication whatever that a stream has been used as an artery of commerce, the Corps of Engineers considers it to be navigable until the courts decide otherwise."

Brig. Gen. C. W. Kutz, in a written discussion, raised the question of whether it ought not to be possible to establish criteria by which the navigability or non-navigability of a stream can be determined without appeal to the court in each case. He cited the Supreme Court's findings as to the navigability of the Greene, Grand and Colorado rivers in the suit between the federal government and the state of Utah as to control of lands under water on those rivers as providing a basis for a start in that direction. The master in that case based his findings on susceptibility to being made navigable rather than on the evidence of past use, and in the determination of susceptibility he took into consideration such matters as slope, discharge, channel depth at the gaging points and drainage area.

Sanitary engineering division

At the Montebello filters at Baltimore, Md., a dilute liquid alum is manufactured from bauxite and sulphuric acid. James W. Armstrong, filtration engineer, described the manufacturing process and the experiences that his department has had with the equipment and materials employed. The alum is manufactured by adding properly proportioned amounts of pulverized bauxite, sulphuric acid and water in a lead-lined steel tank. No artificial heat is employed. The liquid is diluted to a 2½ per cent solution before it is used in the water-purification process. The net cost of the alum is $11.62 per ton.

Deep tunnels driven through rock are of great advantage in delivering a water supply to a large city when it is necessary to pass through a highly congested area, according to Walter E. Spear, of the New York Board of Water Supply. Tunnels are particularly advantageous in New York, where the great amount of street space taken up by subways leaves no room for water conduits of major capacity. A tunnel is secure against earthquake disturbances. Because of the great depth at which the New York tunnels are driven it is not necessary to confine the location to city-owned property. Rights-of-way for the latest tunnel when it passed under private property averaged about 2c. per

foot of tunnel. In the discussion that followed the presentation of Mr. Spear's paper it was brought out that slates and shales were found to be the most favorable rocks for tunnel construction. Limestone is the most unfavorable.

The Wards Island sewage-treatment plant now under construction by the city of New York is the first unit in the comprehensive plan for ending the sewage pollution of the surrounding waters. As described by Richard H. Gould, of the department of sanitation, it will treat the sewage from a part of upper Manhattan and part of the Bronx. It is of the activated-sludge type, comprising preliminary settling, aeration and final settling. Sludge is to be barged to sea in specially designed tankers. The dock and seawall, the first contract that was let, have been completed, and the tanks, galleries and conduits, the second contract, will be finished in a short time. Twenty more contracts must be undertaken before the project will be complete, but most of them will be of minor magnitude. The design of the interceptors to bring sewage to the plant is about half done. It is scheduled to be completed during the current year.

A fourth paper in this session, describing the chemical behaviour of ferric salts when used as a coagulent in water-supply work, was given by Prof. Edward Bartow (University of Iowa).

City planning division

Just one subject was given consideration at the meeting of the city planning division: the equitable distribution of benefit assessments for city street widenings. The subject was presented first in a paper by Hyman Shifrin, assistant chief engineer, division of sewers and paving, St. Louis, Mo. It was given lengthy discussion by Herman H. Smith, New York; George H. Herrold, St. Paul; Oliver D. Keese, Los Angeles; and Philip H. Cornick, of the Institute of Public Administration, New York.

Mr. Shifrin described in some detail the practices in use in St. Louis in distributing the cost of street widening and indicated the improvements that he considered desirable. The most common practice is to use the aggregate of condemnation awards as the basis for the determination of the assessments to be levied. There are four classes of beneficiaries when streets are widened beyond the width necessary to give access to the fronting property. First, there is the vehicle user in general, who now escapes assessment. There should be a supplementary license fee, he said, for motorists who live within the area estimated to be benefited by the new improvement. Second, there is the owner of the fronting property. He is benefited by having his property made potentially more valuable through the possibility of multi-story construction or business use. The benefit is delayed, however, until the latent commercial possibilities are utilized. The third class comprises the owners of centrally located property, which had been handicapped heretofore by being difficult of access to residents of outlying districts. Residents of the district that feeds the new traffic artery make up the fourth group of beneficiaries, as they are enabled to reach focal points with a saving of time. Assessments of the benefits to this group are most difficult, he felt, and he suggested that they be relieved, a development which would be entirely equitable if the supplementary vehicle-license fee were instituted. He further advocated the formation of metropolitan districts for highway development.

In his discussion Mr. Smith described the practices of New York City in this regard. New York confines assessments to the fronting property when the street is 60 ft. wide. Streets from 60 to 80 ft. wide have their costs divided between the fronting property and a local district that extends half way to the next wide street. Streets in the next class, from 80 to 100 ft., bring in the borough as a contributing area. When the street is wider than 100 ft. the city as a whole also shares its cost.

Mr. Herrold recited the history of benefit assessments for this purpose in St. Paul. The principle of benefit assessments is correct, he stated. Mr. Cornick presented a definition of the benefit assessment principle, calling it the recapture of a portion of the unearned increment to realty values resulting from the improvement. He also stressed the difficulties in the way of making the assessments on a rational basis. O. D. Keese commented upon the advantages and disadvantages of three methods used in California, frontage, district and *ad valorem* assessments. The frontage basis is the only one in which the engineer is not required to use his own discretion as to the amount to be assigned to each piece of property. Frontage alone, however, results in serious inequities.

Committee reports

The work of the committee on concrete and reinforced concrete was reviewed by Prof. Clyde T. Morris (Ohio State University) who outlined the work under way at the University of Illinois on concrete arches. Current work is confined to the problems of multiple-span construction, several three-span models nearly 100 ft. overall being set up in the laboratory. The research is concerned both with the bare arch ribs and with superstructure participation. Model tests of these same structures have been made both at Ohio State University and Case School of Applied Science, and good comparable results have been obtained. One of the notable observations in the Illinois tests has been the close conformity of thrust lines to theoretical positions, even after considerable cracking has occurred in the arch ribs.

After two years' work the committee on earths and foundations has prepared a report that was referred to but n read by Lazarus White (New York chairman. The report includes a com parison of the theory of the compress bility of thick layers of saturated cla with results obtained on an actual build ing. Also descriptions and analysis the behavior of several buildings on so ground are included. The committe on irrigation hydraulics through it chairman, D. C. Henney, and its secre tary, J. C. Stevens, recounted its accom plishments of the past ten years. A present the evaporation studies hav been completed, and a report on the sil problem is being prepared by Mr Stevens.

Tall building design

Since last year, when the second progress report on windbracing in tall buildings gave the committee's recommendations, considerable discussion has been received. The report at this year's meeting considered these discussions, presented a somewhat detailed explanation of wind-design methods, with particular emphasis on the Spurr method, and reported on welded joint tests made at the University of Toronto under the supervision of the chairman of the committee, Prof. C. R. Young.

The committee answered most of the questions raised by discussors but did not see fit to change any of its previous recommendations. Vibrational characteristics of buildings must be determined experimentally (and probably cannot be determined analytically) before buildings can with certainty be designed to yield a desired degree of comfort to the occupants, the committee concluded.

Regarding the Cross method of analysis, the committee concludes that it is satisfactory for shallow bracing systems in buildings of moderate height "in which the frame has been previously proportioned so as to maintain the floors substantially plane." For tall structures, however, it may be unwieldy and particularly so if translation of joints needs to be taken into account. If the Cross method is to be applied to such structures, it is desirable to isolate particular stories (by hypothetical hinges) and apply the method to them individually, adding to the direct stresses in the columns the stresses in the columns immediately above.

In so far as design methods are concerned the committee concludes that the portal method of design may be used with satisfaction for buildings of moderate heights and proportions, that the cantilever method is generally more suitable for high frames but that the Spurr method is to be preferred as having wider applicability and greater accuracy, since it takes into account the elastic action of the various members of the frame.

The tests at the University of Toronto were made as a result of the recognized importance of rigid wind connections. Although not extensive, they indicate

that welded connections are stiffer than rivited T's for the same orientation of the column and that welded T's are not so stiff as the built-up gusset-plate type of welded connections.

In discussion of the report, Prof. Hardy Cross (University of Illinois) emphasized that in wind-design problems and others involving statically indeterminate structures, the purpose of the analysis is merely to determine if the structure corresponds to the design. D. C. Coyle remarked upon our lack of knowledge regarding the relative stiffness of the frame and of the building as finally completed and inclosed. He expressed the belief that Spurr's "yardstick" of deflection, of 1/500 of the height in the frame, is good and produces satisfactory buildings, but that it may be useful to know what deflection occurs in buildings so designed after they are incased. H. G. Balcom concurred in the opinion that Spurr's method of design would produce a satisfactory building. He pointed out that the method is basically an adaptation of the portal method to the problem of the tall slender building. The committee should give more attention to wind connections, in Mr. Balcom's opinion.

A paper treating of a simplified method of wind analysis, based on the Cross method of balancing fixed-end moments, was presented by Prof. L. E. Grinter (Agricultural and Mechanical College of Texas). The "simplified method of successive corrections," as Professor Grinter has called it, purposes to secure the final joint moments by only one cycle of balancing. This is accomplished by forcing the structure into its estimated deflected position, as caused by the applied loads, calculating the fixed-end moments that result and balancing them. In cases where the joint restraint is still appreciable after this first balancing, the final column moments can be obtained by multiplying the first balanced moments by the ratio of the true shear to the computed shear in that story. Girder moments are obtained by dividing the sum of the corrected column moments at each joint between girders in the same proportion as that of the uncorrected girder moments.

Steel-column research

One of the most notable events of the meeting was the presentation of the final report of the committee on steel-column research by Dean F. E. Turneaure (University of Wisconsin). This committee, formed nearly ten years ago, has carried on extensive tests at the University of Wisconsin under Prof. M. O. Withey.

Among the conclusions in the report the following, in abstracted form, may be noted:

1. Columns tested with hinged ends and eccentric loads give results both as to deflection and distribution of stress agreeing very closely with theoretical analysis within the limits of elasticity of the material.

2. The ultimate strength of such columns agrees fairly well with the theoretical strength based upon the yield point.

3. In columns in a truss (compression members) the amount of eccentricity and restraint are the most important factors of the several that affect the strength.

4. A rational column formula can best be constructed on the basis of the theoretical formula for eccentrically loaded columns, using values of eccentricity and free length of column derived from truss analysis. This formula is:

$$P/A = \frac{\text{yield point}}{1+a \sec \sqrt{\frac{P}{AE}} \cdot \frac{l'}{2r}}$$

in which a = eccentric ratio and l' = free length of column.

5. For columns bent in single curvature an eccentric ratio of $\frac{ec}{r^2} = 0.25$, to include both crookedness and eccentric application of load, and a free length of three-quarters the full length for riveted connected members are suggested as reasonable values for ordinary trusses.

6. For a working formula the parabola is a good substitute for the theoretical formula up to values of l/r of 160 for structural steel. The equation of this parabola is

$$P/A = 25{,}600 - 0.425 \left(\frac{l}{r}\right)^2.$$

It deviates from the theoretical curve by less than 2 per cent up to $l/r = 160$. (The committee remarks that straight-line formulas may be satisfactory up to an l/r value of 100 or more, but that they are not adapted to long columns and are not readily modified to fit a variety of steels.)

7. For large structures the calculation of secondary stresses will enable the values for the eccentric ratio to be more closely estimated and the columns designed accordingly.

8. Compression members bent into reversed curvature, due to loads applied with opposite eccentricities at the two ends, will have their maximum stress at the ends of the members. The allowable unit stress requires little reduction for length, but the eccentricities in this case (as shown by secondary-stress calculation) are likely to be greater than the value of 0.25 assumed in the formula.

9. The strength of lacing bars depends largely upon the end connections.

10. Outstanding flanges whose unsupported width does not exceed 15 times their thickness will have a strength under centrally applied loads equal to the yield point of the material.

Grade separations

The joint session of the construction and structural divisions was devoted to three papers on grade-crossing separations, with the exception of brief reports of the construction division's substructure committee. The New Jersey express highway was described by H. W. Hudson, engineer in charge. Articles on this new development have appeared in *Engineering News-Record*, Jan. 5, 1928, p. 4, and Jan. 12, 1933, p. 43.

G. H. Wilsey, engineer, Foley Brothers, Inc., New York, discussed some of the contractors' problems in railroad grade-separation work, concluding that best economy is secured when the contractor has full charge of all phases of the work, with the possible exception of raising track, an operation that does not readily lend itself to a unit-price bid.

The practices of the Delaware, Lackawanna & Western Railroad relative to grade-crossing work were outlined by John L. Vogel, bridge engineer of the company. In cities where traffic is under some control and columns are permissible in the street the Lackawanna prefers to use the girderless flat-slab structure, as exemplified by its work in Elmira, N. Y. (*ENR*, Dec. 8, 1932, p. 678). This type of structure is also best suited in locations where switching operations are carried on. Second choice for these locations is the deck plate-girder, underclearance permitting, and otherwise the through plate-girder. In open locations, highway overcrossings are, when possible, composed of a through plate-girder span on open rigid-frame type abutments flanked by reinforced-concrete column-bent approaches with a slab of the two-way type. Over branch lines, span lengths permitting, a reinforced girder and T-beam structure is preferred.

Saving highway delays

Three papers were presented before the highway division, one on the economics of highway delays and the other two on control of utility cuts in pavements. Speaking on the cost of highway delays, S. Johannesson, designing engineer, New Jersey State Highway Commission, declared that the cost of preventing or eliminating delays to highway traffic must, in general, be compensated for by the value of time saved traffic. By averaging all classes of vehicles and the number of occupants per vehicle, Mr. Johannesson arrived at an average value of 1.0463c. per vehicle per minute, 10 per cent of which represents vehicle charge and the remaining 90 per cent time value to the occupants. This value of time varies with conditions—for example, 2c. was used on the Holland Tunnel approach route because of the large amount of truck traffic.

Control of pavement cuts in Washington and New York City was described in papers by H. C. Whitehurst, director of highways, District of Columbia, and R. A. MacGregor, engineer of maintenance, Borough of Manhattan.

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A Word of Courage

With the directness and practical spirit that marks the construction man, George B. Walbridge at the Detroit Congress last week uttered a pertinent bit of advice. He remarked that the country at large, most of the people at any rate, is unemployment-minded, or dole-minded, and this spirit is destructive since dole accelerates dole and the only cure is work. We are and will be accused of selfishness, he said, when we advocate construction work as the path of recovery, but he urged, "Do not let this stop you! Continue your efforts in the conviction that you are right and you are laboring for the good of your fellow-citizens and the nation." Such a word of courage deserves to be spread through the length and breadth of the engineering community. It voices the spirit that will overcome the fear and reaction that today numbs initiative.

Provide for Quick Action

With amendment of the Relief Act in prospect and the possibility that various other developments of the next few months may have a bearing on construction problems, it is obviously desirable that every construction group equip itself for quick action to advise or aid in their broadest consideration. By such a course the knowledge and viewpoint of all separate factors in construction can be made available for the best solution of the particular problem at issue. One of the final acts of the meeting of the Construction League last Saturday was to authorize its chairman to establish a quick-action contact in each of the member organizations in order to enable him to obtain an instant focusing of views (or, if necessary, action) when occasion may demand. The wisdom of the step needs no proof. Corresponding emergency organization within every construction group, properly correlated with the central plan and scope committee which the congress organized, is capable of contributing materially to the general welfare.

Necessity Breeds New Thinking

No one in attendance at the Detroit highway and building congress last week could fail to be impressed with the unprecedented development of thoughts and ideas that marked the gathering. The stress of conditions which inspired the work of the congress has been discussed on another page in its bearing on unity of spirit and action, but its effect to stimulate thought is also worth reflection. Every department of construction and its tributary industries is now engaged in studying its problems in a new light, more broadly and penetratingly. Even the operations of so thoughtful a body as the Highway Research Board exhibit this influence, for the thinking of the board is now trending toward study of the fundamental national economics involved in road construction and transportation and less to the technical problems mainly dealt with heretofore. Corresponding developments appeared in the discussions of other organizations. They are so constructive in character that they may be rated as one of the compensating elements of value of the depression. In furthering the progress of construction they will also serve the community.

Research in Engineering

Two committee reports at the convention of the American Society of Civil Engineers last week contributed an invigorating atmosphere to the structural division sessions. In making its final report after a decade of studious endeavor, the steel-column research committee not only measurably advanced knowledge of column behavior but codified this knowledge for design use. Likewise the committee on windbracing in tall buildings brought its results and recommendations to such definite conclusions that wind-design practice should be immediately improved. Considering the present state of building activity, both reports have a somewhat academic flavor. But in this regard they illustrate almost perfectly the theory of utilizing dull periods of business to prepare for times of prosperity. They emphasize also the high place that research occupies in the work of the society. No other activity is so potent in welding the membership into a cooperative body and maintaining the necessary cohesiveness through times of prosperity and stress. The devotion of the personnel of these two committees to their respective tasks is quite as notable as are the scientific results of their studies.

A Way to Save Losses

That there are large opportunities for saving values by rehabilitation of old buildings is coming to be more and more widely recognized. The losses that real estate has suffered are not altogether due to the depression; to a considerable degree they lie in depreciation and obsolescence unheeded during the prosperous years. When real-estate earnings were ample, no thought was given to setting aside reserves out of these earnings to cover obsolescence. At present the slackened demand resulting from business depression is bringing this depreciation painfully to attention. The outward movement of population from the usually neglected inner districts of cities is accelerated, further increasing the loss of value. Skillfully planned rehabilitation operations are the way out, as has been shown by actual trial in a number of cities. Leonard Reaume, a Detroit real-estate banker, in addressing the Construction League last week asserted that rehabilitation pays well and cited instances in proof. He added, however, that for best effect it should be accompanied by a system of neighborhood control through which a region of adequate size could be stabilized by unified development. In detail these possibilities still need to be worked out, but their effect in saving values is promising. For, to quote Mr. Reaume again, we are all in the real-estate business whether we want to be or not.

Value Still Controls

In a time when low cost assumes abnormal significance it is important to recall that value still must govern sound planning and construction, and that best suitability of material and form to function is the way to greatest economy. Where this rule is disregarded there is danger that un-

suitable methods and materials may be adopted and serious loss may be incurred. A special instance that has present-day importance is the matter of low-cost construction for secondary roads. The prominence of the term "low-cost" has repeatedly led to the false conclusion that low-cost and low-grade materials are best adapted to this field. Experienced highway engineers and constructors know the error of this conclusion, for they have learned that proper road service is obtained only by careful selection of materials and methods. Administrative officials, however, are more easily led astray in the effort to bring down construction cost. Where such danger appears, it is the engineer's part to point out the truth and insist on the economy.

Determining Navigability

A proposal warranting further study was put forward by Brig. Gen. C. W. Kutz at the meeting of the waterways division of the American Society of Civil Engineers as part of the discussion of what is a navigable waterway. Brig. Gen. G. B. Pillsbury, in the paper under discussion, had said that the navigability of a stream is not determined by fiat or by the application of a formula, it is a matter for the courts to determine in each case upon analysis of facts bearing upon whether or not the stream is a useful artery of commerce or could be so used. General Kutz believes that the problem should be approached in a more rational manner. He cites the master's findings in the suit between the United States and Utah over control of lands under water in the Colorado and other rivers, in which the master based his findings not upon uncertain records of past use of each river but upon such definitely determinable factors bearing upon its future use as slope, form of channel, and flow. In view of the fact that the United States Supreme Court accepted these findings in so important a case, General Kutz thinks that with them as a basis it should be possible to lay down rules for determining the navigability of a stream within reasonably close limits. Thus, when a dam or a bridge is planned the question of navigability could be determined in the early study instead of being left an open question as now until the later stages, often involving expensive changes in design and not infrequently expensive litigation. The possibilities of General Kutz's proposal should be explored; the subject is one which the waterways division might well take under consideration.

Planning to the Fore

WHAT THE highway and building congress accomplished for the general spirit and organization of construction has been appraised on an earlier page. Its effect on the thinking of the men in the construction field is no less significant, clearly marking the beginning of a growth that is destined to exert a profound and lasting influence on construction activities.

Throughout the congress proceedings there was an unmistakable trend toward recognizing the commanding value of far-sighted planning. Quickest in this understanding were the architects and engineers, but contractors, materials and equipment people and the diverse interests represented in the Construction League gave equal evidence of its influence. Each group realized that its future adjustment to the others and to the community at large, and indeed the very effectiveness and soundness of its work, will depend on wise long-term planning. In this planning the effectiveness of the construction industry's contribution will be measured by its ability to coordinate its thinking with that of the entire fabric of business and finance.

We all have learned in the last year or two that construction is a highly unstable activity. More, we have learned that contrary to all economic dictates the most active construction goes on in busy times and the least construction in depressed times, when it should be greatest. This instability is due to more than financial causes. In part, at least, it is due to a failure to correlate construction with public needs and uses. In part it is due to lack of advance budgeting. In most instances there is also a failure to balance projects against results, both immediate and deferred. All these contributory causes of construction instability trace back directly to lack of long-term planning.

It is becoming more clearly apparent each passing day that the service of improvement which construction renders to the community ought to be studied closely in its relation to economic and business changes. Without such correlation there can be little hope of making construction investment duly solvent and permanent. Through proper planning on a long-time outlook, construction can be made to control some of these changes and to be controlled by others. It can, for example, help to stabilize the uses and values of property in cities, and curb the unrestrained wildness of growth with which the land speculator has damned so many cities. Here construction planning can control economic changes. In other instances, as where the industrial character of a region is changed by technological advancement or by less tangible influences, proper attention to these changes will be a determining factor, in guiding construction along sound paths. For example, attention has recently been drawn to certain districts where industries are now declining through transfer to more favored areas or through technologic change and replacement; in such districts, evidently, construction operations should consider carefully the course of change, if they are to be sound.

It might appear that long-term planning, while of interest to architects and engineers, has little relation to roadbuilder, contractor or manufacturer. The falsity of this conclusion, fortunately, is understood by the latter interests, as was evident at Detroit. They are all so vitally dependent on the general health and stability of construction as to make their interests quite inseparable. For all of them the dominant importance of long-term planning has become solidly established, and they realize fully the industry's cooperative responsibility.

In this planning, as stated above, it seems clear that the construction industry itself is bound to play a leading part. The coming year, it may be hoped, will bring definite progress to establish means and methods of planning, in which construction, represented by a more closely knit industry than ever before, will cooperate effectively with other interests. Advance of this kind will not merely benefit construction but will contribute decisively to public welfare and prosperity.

NEWS OF THE WEEK

Foundation Construction Is Begun on New Orleans Bridge

The first pile for the foundation of the $13,000,000 Public Belt railroad and vehicular bridge across the Mississippi River near New Orleans was driven on Jan. 20. The work at that point is under the supervision of the Macdonald Engineering Corp. of Chicago, Ill., contractor for the substructure of the approaches to the main span. Siems-Helmers, Inc., of St. Paul, Minn., contractors for the substructure of the main span, who have the undertaking of placing the bridge piers in the river bed, are expected to begin their activities at the bridge site shortly.

Philadelphia Gas Works To Expand System

A comprehensive plan of reconstruction designed to increase the operating efficiency of the Philadelphia Gas Works has been announced by F. M. Milward Oliver, vice-president of the company. It is estimated that the reconstruction will take between four and five years to complete. The new plan has been made necessary by changed living conditions, shifting population centers and other phases of growth in the area served by the gas works.

Among the first major steps of the general plan to be undertaken are: construction beneath the Schuylkill River just above the Passyunk Ave. bridge of a tunnel of sufficient size to hold two 30-in. transmission mains, through which gas will be piped to serve the West Philadelphia area; the installation of 2.5 miles of new 30-in. main; the installation of 1.85 miles of 20-in. transmission main and of 2.8 miles of 16-in. main to increase the supply of gas to the southeastern portion of the city. There is also involved the installation of additional pumping capacity.

Bids for the tunnel under the Schuylkill River have already been received by the company, and work on this step of the plan will begin early in the spring. It is expected that the tunnel will be completed and the mains ready for use by next September.

Texas Irrigation District Goes Into Liquidation

Water Improvement District No. 1 in La Salle County, Texas, which was organized several years ago for the purpose of constructing and operating what was to have been one of the largest irrigation systems in the state, has been dissolved and is now in process of liquidation. By order of the commissioners court there has just been burned $7,000,000 of bonds of the district which were voted but were never sold.

In 1925 La Salle County Water Improvement District No. 1 was created and a total of $7,331,000 bonds were voted and issued for the purpose of constructing a vast irrigation system. The completion of a detail survey required considerable time and in the meantime the depression began to set in which made the bonds hard to sell, and offers made were not acceptable. Finally when the depression hit with full force and real estate values fell flat it was decided that it would be impracticable to carry the project through and the past year land owners in the district voted to dissolve it, and automatically the liquidation of the district fell to the lot of the county commissioners court. Out of the total issue $122,000 of the bonds were accepted by creditors, leaving intact and unsold $7,209,000.

The total indebtedness of the district as fixed a month ago when all records of the district were turned over to the county was $147,468.83. This indebtedness must be settled by taxation on the land within the district, about 84,000 acres, over a period of ten years.

Commission Control Over Highway in Kentucky Upheld

The law passed by the general assembly of Kentucky in 1932 fixing maximum loads for trucks, axle loads, height, width and length limitations, also vesting certain regulatory rights in the highway commission, has been reaffirmed by the state court of appeals in the case of the Ashland Transfer Co. and the Aetna Oil Co. against the state highway commission. The law was attacked on the ground that it was an unconstitutional delegation of power by the legislature to the highway commission. Among other things the commission was given power to suspend the law under certain circumstances and to grant permits to trucks for operating under the emergency conditions. The court upheld the legislature's power to delegate this authority to the commission.

Sewerage Finance and Treatment Problems Discussed at New York Meeting

AT THE FIFTH annual meeting of the New York State Sewage Works Association held in New York City on Jan. 17, three papers were presented, relating to sewage work financing, explosion hazards in sewage works and a newly developed method of sewage treatment. In the evening the members and guests of the association joined with the Sanitary Engineering Division of the American Society of Civil Engineers in their annual dinner. It has become customary to fix the date of the association meeting so that this contact of the memberships of the two societies will be made possible.

"Fact and Fancy in Sewerage Financing," was the title of a paper presented by Abel Wolman, Baltimore, Md. In this paper Mr. Wolman described a plan for allocating the cost of a sewerage system among the various beneficiaries in the way that he considered most equitable. The plan is a re-statement of that described in *ENR*, June 2, 1921, p. 944. It is based upon the fundamental principle that public and private benefits should be separately considered and that there should be a differentiation between fixed and operating charges. The plan embodies the payment for sewer systems by a combination of property tax, annual front foot assessment, house-connection cash payment and sewerage service charge. All capital costs are met by the tax rate and by front foot assessments, and expenses of maintenance and operation are covered mainly by charges for service rendered. The system with some modification, depending on local situations, has been applied in Maryland to the financing of the water supply and sewerage facilities for some 175,000 people. Mr. Wolman expressed his appreciation, however, of the fact that these basic principles must be deviated from at times because of sectional prejudices against one or another form of payment.

The explosion and health hazards in sewage works operation and suggested methods for avoiding them were described by G. W. Jones, of the U. S. Bureau of Mines, Pittsburgh, Pa. In the paper and the discussion that followed the highly toxic nature of hydrogen sulphide gas was emphasized. This gas is not particularly harmful when it can be smelled but has the characteristic of paralyzing the olfactory nerve when in a dangerous concentration.

A modified chemical-precipitation method of sewage treatment developed in the Guggenheim Laboratories was described by George H. Gleason, New York, N. Y. The process consists of flocculating the sewage with ferric sulphate and lime, sedimentation, incineration of the sludge with the resultant recovery of the iron, the treatment of the settled sewage by zeolite beds for the removal of the basic nitrogen compounds and the recovery of ammonia from the waste regeneration water. The process was first developed on a small laboratory scale some months ago and has been in operation on an experimental scale at the Guggenheim Laboratories in New York City where it treats sewage taken from the Dyckman St. outfall. The figures cited by Mr. Gleason show a reduction in B.O.D. from 150 parts per million in the raw sewage to 5 parts per million in the purified effluent. Suspended solids in the effluent averaged 1 part per million.

At the business meeting of the association A. F. Dappert, State Department of Health, Albany, N. Y., was elected president for the ensuing year. E. B. Besselievre, New York City, was chosen vice-president. A. S. Bedell is secretary-treasurer.

All-American Canal Preliminaries Approach Appropriation Stage

NEGOTIATIONS on the provisions and terms of the contract for building the All-American Canal, as provided in the Boulder Dam Act, have been actively under way during 1932 and have reached the point permitting requests for initial appropriation. The original contract, which provided for the inclusion of Coachella Valley land, was amended and a revised agreement between the government and the Imperial Irrigation District was approved by a seven to one vote of the District on Jan. 12, 1933. For a period of 30 days after final validation of the amended contract it is possible for the Coachella Valley land to petition for inclusion and the works are to be reduced accordingly.

Prior to 1932 the Imperial Irrigation District and the Department of the Interior prepared a contract which received the approval, as to form, of the secretary in November, 1931. The District election on Feb. 11, 1932, confirmed the contract by a majority of more than five to one. This contract provided that before it became effective the District was to enlarge its boundaries to include a major portion of other lands to be served by the All-American Canal, including extensive areas in the Coachella Valley. Because of the benefits which the canal would provide for the lands in the Coachella Valley, it was assumed that the area would voluntarily petition for inclusion. Subsequently, opposition developed in the valley against joining the District, making it apparent that there would be long delay in meeting the terms of the original contract.

During the summer the Board of the Imperial District notified the Coachella Valley organization that if the necessary petition was not presented by Sept. 1, Secretary Wilbur would be requested to amend the contract so that the District might proceed with the canal project. The petition was not presented and on that date the District began negotiations for securing an amended contract. Action resulted in the series of conferences held in Washington during November between the Department of the Interior, a newly elected Board of the Coachella Valley County Water District and representatives of the Imperial Irrigation District.

The contract was amended by the removal of the clause requiring the inclusion of the Coachella Valley land before the contract was effective and substituting a provision that the contract would become effective upon execution with the additional provision that after that date the Coachella Valley was permitted a specified time for presenting a petition for inclusion. If this petition is not presented the Coachella lands are not to be included and the canal project and capacities will be reduced accordingly. The time limit fixed by the contract for the petition for inclusion states: "At any time prior to the expiration of 30 days from and after the time on which a confirmatory judgment . . . declaring this contract in all respects valid and duly authorized shall have become final." The petition from Coachella Valley must be sufficient to include at least 90 per cent of land to be served by the canal in that area.

The amended contract also provides that the Imperial District will include the public lands adjacent on the East and West Mesas and the conditions to be imposed upon these new lands are set forth in the contract. Aside from these specific changes, the new contract is similar to the original one. The amended contract was executed by Secretary Wilbur on Dec. 1, was approved by the California state engineer and the California District Securities Commission prior to the vote on Jan. 12 which approved it by a seven to one majority of the District.

With the exception of possible legal delays as to the provisions of the contract, the Imperial Irrigation District is now able to definitely proceed with preparations for active work on the project. The first requirement will be an initial appropriation by Congress for active construction work as required by the provisions of the Boulder Dam Act.

M. J. Dowd is chief engineer and general superintendent of the Imperial Irrigation District.

Subway Approved by Camden for Delaware River Bridge Line

The City Commission of Camden, N. J., on Jan. 17 formally approved a plan for a subway line to connect with the proposed high-speed line over the Delaware river bridge. The plan was proposed by Ralph Modjeski, designer and builder of the bridge, and calls for a subway from the bridge terminus in Camden to 4th St. parallel to Bridge Ave. and then along 5th St. to the terminal below the Broadway station of the Pennsylvania Railroad. Plans for the Philadelphia end of the bridge were approved by the city council last week and call for a connection with the 8th St.-Ridge Ave. subway at Vine St.

Engineers Attend Memorial Service for John R. Slattery

Members of the American Society of Civil Engineers attended a memorial service in honor of the late John R. Slattery during their visit to West Point, N. Y., on January 20. The services were conducted by the chaplain of the United States Military Academy in the Cadet Chapel. At the time of his death last fall Col. Slattery was general manager of the New York Independent Subway system.

Federal Court Says 5.17 Per Cent Return Not Confiscatory Today

In a decision handed down on Jan. 12 by three federal judges it was held that rates prescribed by the Illinois Commerce Commission for the Kankakee Water Company which would yield a probable return of 5.17 per cent on investment, were not confiscatory.

The decision denied the water company the right to charge a rate higher than that set by the commerce commission. The company had asked for a temporary injunction to restrain the commission from enforcing rates that would limit the company to the 5.17 per cent return. One paragraph of the decision read as follows:

"Under the existing generally depressed industrial and financial conditions, indicating a greatly abnormal condition both generally and locally, all of which appears in the record, we are not warranted in finding that the probable return of 5.17 per cent upon the valuation, furnished by the commission's prescribed rates, is confiscatory. In this connection we have considered the evidence of present return in industrial enterprises of other character and that of similar utility companies, as well as the fact that plaintiff makes no claim and furnishes no evidence that new capital is at present needed in its business."

CONSERVATORY OF THE U. S. BOTANIC GARDEN, WASHINGTON

Aluminum purlins, trusses and glazing bars are used in the new conservatory of the U. S. Botonic Garden in Washington to reduce maintenance costs. Cantilever trusses of aluminum form the main dome. Steel is used for columns and in some of the smaller trusses. The Maryland Ave. frontage of the building is a low structure faced with limestone, the dome of the conservatory showing above it. The structure is being built for the government by the George A. Fuller Co. of New York.

Sewer Bond Issue Defeated in Springfield, Mo.

A proposed $275,000 sewer bond issue in Springfield, Mo., was defeated on Jan. 12, falling considerably below the necessary two-thirds vote. Defeat of the issue was attributed by city officials to voter indifference, to activities of groups that actively fought the proposal and to the general desire of taxpayers to avoid even a slight increase in their present tax payments. More than 800 men had registered at the city hall, hoping to obtain jobs on the improvement should the issue carry. Hearings are scheduled for the present month on $300,000 worth of damage suits filed against the city because of alleged damages that resulted from improper sewer facilities.

Washington Notes

By Paul Wooton
Washington Correspondent

Liberalization of the Reconstruction Finance Corporation act is expected before the end of the short session of Congress. Sentiment in Congress, however, has not crystallized as to the specific changes that should be made in the present law. There is still strong opposition to any plan likely to result in tax increases. There is increasing sentiment for loans to private industry where a large proportion of the total will be expended for wages and salaries. This is also true of the proposal to loan funds to those engaged in the production of manufactured goods for export.

If the Reconstruction Finance Corporation act is to afford the relief to unemployment indicated by the amount of money it makes available, it must be liberalized to a greater extent than is provided by the proposed Wagner amendment, many believe. It is feared that the substitution of "needful and economically sound" projects for "self-liquidating" projects would lead to confusion. There is an increasing tendency to believe that the only way to make certain of a large program of public works would be to give the board of directors of the corporation much wider authority in the granting of such loans. In the present act Congress has attempted to write specifications as to what may be done. It now has been proven that an insufficient volume of loans qualify under those specifications.

Applications for construction loans have fallen to an average of 36 a month. In the past about half the applications have been approved. The average of loans granted has approximated $1,000,000. Even if the present average does not diminish further the expectation under the present law would not exceed $18,000,000 a month. This is recognized as an insufficient amount to begin to deal with the volume of unemployment.

There is very general agreement that the provision which precludes the use of tax money should be eliminated. There will be some opposition to the provision in Senator Wagner's amendment for reducing interest to a rate of one-half of 1 per cent more than the rate of interest which the United States has to pay for the money. In some sections of the country, at least, a rate that low never would be matched by private lenders. There would be strong support in Congress for a rate high enough to insure refinancing as soon as the money is available from private sources. Many feel that the interest situation would be met if all borrowers could be given assurance, without limitation, that there would be a rebate of all interest collected by the government in excess of the amount on which the loan was refinanced. At the same time it is recognized that the interest rate is one of the principal obstacles in the way of a number of important projects, including the 38th Street tunnel in New York.

Strong pressure is being brought to secure a more liberal policy toward municipal electric plants. At present the board feels that it is unsound to create one facility by destroying an existing one but if applications for municipal plants show that efforts have been made to purchase existing facilities on a basis of actual valuation it would be assured of serious consideration.

Highway-aid legislation

So many protests are reaching members of the House of Representatives against the action of the House leadership in refusing to allow the federal aid authorization bill to come up for a vote that increasing pressure is being brought for the consideration of that measure. Friends of the bill feel more encouraged than they did a week ago.

It also is becoming increasingly evident that it will be difficult to extend the federal tax on gasoline if no federal aid for the next fiscal year is authorized. This is doubly important from a revenue standpoint as plans are being laid for the increase of the levy from one cent to two cents per gallon.

New York Makes Appropriation To Extend Subway Operations

An appropriation of $1,462,925 to enable the New York Board of Transportation to complete and place in operation within the next six months twenty-two more miles of city subways has been voted by the Board of Estimate. The board also authorized the issuance of city securities sufficient to raise the money.

The new lines will extend municipal operation, now confined to Eighth Ave., well into Brooklyn, Queens and the Bronx. All of the extensions will be directly linked to the Eighth Ave. line by means of underwater tunnels. The Bronx operation will extend to 205th St. under Grand Concourse. The Brooklyn operation will extend to Church Ave. and Gravesend Ave. and the Queens operation, by way of the 53d St. crosstown line in Manhattan, will reach as far as Roosevelt Ave. in Queens.

Controller Berry, it was reported, will endeavor to finance the work through the sale of special corporate stock notes, to be replaced by bonds at some later date when a long-term bond issue can be floated.

Trial operation has been under way for some weeks from the Chambers St. station, the present lower end of the Eighth Ave. line, to the Borough Hall station in Brooklyn. It is expected that revenue operation of this extension will be undertaken within a few weeks which will allow the new city subway to tap the heavy traffic center of Brooklyn.

San Francisco to Charge for Contract Time Extensions

All future applications for extension of time on San Francisco city contract must be accompanied by certified checks to cover cost to the city of any additional inspections and engineering, according to an order recently made. The new rule, it is estimated, will save the city between $20,000 and $25,000 a year. The action was taken following a report from the controller that a five months' extension of time on the Third St. bridge granted to the contractors will cost the city $12,500.

Railroads Ask to Be Relieved of Building Los Angeles Station

Representing that construction of a union passenger station in Los Angeles is not justified by their financial condition, the Southern Pacific, Los Angeles & Salt Lake and the Santa Fe railroads have requested the Interstate Commerce Commission to revoke its order requiring construction of the necessary trackage. The railroads sought this means of relief as the California Railroad Commission previously had refused to rescind its order requiring construction of the station proper. The cost of building the Plaza station in accordance with the authorized plans is estimated by the railroads at $11,129,965 to $12,481,610. The cost of a so-called "stub" station is estimated at $7,597,404 to $13,386,092.

Declaring that they could not finance this project without borrowing from the R.F.C. and that such a course is not warranted, the Southern Pacific and the Los Angeles & Salt Lake present as an alternative their original proposal, once denied by the I.C.C., for joint use of the Southern Pacific's present station at 6th Street and Central Avenue, thus permitting removal of passenger and freight trains except industrial switching from Alameda St. The cost of this plan, including elimination of grade crossings and erection by the Santa Fe of a new station at its present location is estimated at $3,000,000.

Offer Second Block of Bonds For Colorado River Aqueduct

Issuance of a $4,032,000 block of Colorado River aqueduct bonds to finance construction of the project until May 1 was authorized Jan. 13 by directors of the Metropolitan Water District of Southern California. Bids will be received on the block, the second to be issued by the district, on Jan. 27 at Los Angeles, Calif. The first block, amounting to $2,016,000, was sold recently to the Reconstruction Finance Corporation, which is expected by district officials to bid on the second block.

The district board on Jan. 13 also awarded a $131,385 road building contract to the Morrison-Knudsen Company, Los Angeles. The road, thirty-six miles long, will serve construction activity along the Coachella tunnel unit of the project.

Bids will be opened Jan. 30 on two additional tunnel projects, the Valverde and Bernasconi bores, at the extreme western end of the aqueduct line. The former is to be about seven miles long and the latter one mile long.

New York City Abolishes City Plan Commission

Three New York City bureaus were abolished by the Board of Estimate on Jan. 19 in accordance with emergency messages received from the mayor. The action of the board wipes out the Bill Drafting Department, the Department of City Planning, and the Board of Taxicab Control. The functions of the last named body will be restored to the Police Department which had formerly exercised them. The functions of the old city planning department have been assigned to the office of Herman H. Smith, chief engineer of the Board of Estimate and Apportionment.

Hoover Dam Notes

A careful study is being made of the respective advantages and disadvantages of underground circuits as against overhead circuits between Hoover dam power plant and the high voltage switching station. The Los Angeles Bureau of Power & Light is urging the use of the underground system. The chief engineer of the Reclamation Bureau, the Southern California Edison Co. and the Metropolitan Water District of Southern California favor the overhead high voltage scheme. This latter plan will cost $1,500,000 less than the underground system.

* * *

The six 11-ft. outlet tunnels to the Arizona valve house were started during the week ended January 14. No work has been done as yet on the outlet tunnels on the Nevada side. The fill for the downstream cofferdam is 75 per cent complete. Drilling of high pressure grout holes at the inlet end of tunnel No. 1 was completed during the week. The work of drilling the low pressure holes near the outlet of the tunnel was begun. During the week under review concrete was poured for 285 ft. of side wall and 369 ft. of arch in tunnel No. 1. This brings the total of side wall poured to 3,456 ft. and of arch to 2,629 ft. The side wall, invert and arch sections are completed in the other tunnels with the exception of the plug sectors.

* * *

With most of the work complete on the upstream cofferdam Six Companies, Inc., has reduced its total force from 3,882 to 3,550.

Uniform Bids for Cement Result in State Investigation

The Missouri Senate at Jefferson City, Mo., on January 19 unanimously adopted a resolution for an investigation into the recent purchase of about 1,500,000 barrels of portland cement by the state highway department. It calls upon the highway department to submit to the Attorney General all information in connection with the cement letting, including books and papers.

The cement contract was awarded at $1.35 per barrel, an increase of 50c. per barrel over the 1932 price. The resolution contends that eight or ten companies in widely scattered sections bid exactly the same prices for cement. The resolution further demands that the highway department's records on cement contracts for the past five years be submitted to the attorney-general's office. It asks the Attorney-General to make an inquiry to ascertain whether there has been any violation of the state's anti-trust laws and to institute ouster proceeding against the companies if he finds there has been a price-fixing agreement or understanding among them.

H. C. Whitehurst, director of highways of the District of Columbia, has been chosen president of the American Road Builders Association for the coming year. He succeeds T. H. Cutler, chief engineer of the Missouri State Highway Department.

Former Naval Officer Named Golden Gate Bridge Manager

James Reed, San Francisco, former naval commander, has been named general manager of the Golden Gate Bridge and Highway District and will be in active charge of the Golden Gate bridge project now entering the construction stage. He succeeds Alan MacDonald, who resigned a few weeks ago. Mr. Reed was graduated from Annapolis in 1902 and had additional study at the Massachusetts Institute of Technology. His active navy career included work at the Mare Island Navy Yard, at League Island and Bremerton; he resigned as commander in 1920. The general manager position carries a salary of $12,000.

Extensive preparations are underway for a celebration on Feb. 26 marking the official start of the project. Meantime work is slowly getting started on preliminary excavation for foundations.

SOCIETY CALENDAR

AMERICAN CONCRETE INSTITUTE, annual meeting, Chicago, Feb. 21-24.

AMERICAN RAILWAY ENGINEERING ASSOCIATION, annual meeting, Chicago, March 13-15.

ENGINEERING INSTITUTE OF CANADA, annual meeting, Ottawa, Ont., Feb. 7-8.

SOUTHEASTERN SECTION, American Water Works Association, will hold its annual meeting at Albany, Ga., April 4-6.

INDIANA SECTION, American Water Works Association, will hold its annual meeting at Fort Wayne, Ind., March 28-29.

Toll Bridge Association Holds First Annual Meeting

The first annual convention of the American Toll Bridge Association was held at the offices of the Delaware River Joint Commission at Camden, N. J., on Jan. 16 and 17. There were about 35 in attendance.

The report of the committee on accounting systems presented by Russell G. Cone, general manager, Tacony-Palmyra bridge, discussed matters pertaining to toll bridge accounting and is a step toward the development of a standardized system of toll bridge accounting. The report of the committee on insurance, presented by A. C. Shinkle, indicated that toll bridge insurance has not received much study and is subject to a great variation in rates.

Papers presented at the meeting included discussions of a survey of the toll bridge field, highway bridges, toll rates and bridge income, the Wheeling suspension bridge and toll bridge operation.

Officers were elected as follows: D. B. Steinman, president; Joseph K. Costello, A. C. Shinkle, Oscar H. Klatt, vice-presidents; P. K. Schuyler, secretary, Horace J. Stradley, treasurer. The next annual meeting of the association is to be held in Cincinnati, Ohio. The papers and reports presented will be published as the first proceedings of the association.

Gasoline Used by Draglines Not Subject to Tax in Louisiana

The state of Louisiana has been permanently enjoined from collecting state taxes on gasoline to be used by the Trinity-farms Construction Co. in the construction of levees in Tensas parish. A temporary injunction against collection of the tax obtained in November was made permanent by a special three-judge federal court.

The gasoline in question will be used in the operatoin of draglines and other equipment at the levees and none of it will be used in the operation of machinery or equipment on the state highways. The gasoline used is purchased outside the state and is shipped by rail to its destination.

Pasadena Water Department To Purchase Azusa Power Plant

The Pasadena, Calif., City Board of Directors has authorized the municipal water department to exercise its option to purchase 1,000 acres of land and the Azusa hydro-electric plant of the Southern California Edison Company, Ltd., in San Gabriel Canyon. The land is to be used as a portion of the Pine Canyon reservoir site. The city plans to operate the Azusa power plant, of 2,415 hp. capacity, transmitting the power to the municipal steam-electric plant until such time as the Metropolitan Water District of Southern California takes over the Pine Canyon dam and reservoir for the storage of Colorado River water. When the district takes over the impounding works it will purchase half the power developed at the Azusa plant and the remainder will be taken by Pasadena.

Obituary

EDWARD J. GALLAGHER, 68 years old, a prominent Baltimore builder, died at a Baltimore hospital on Jan. 19. Death was due to pneumonia.

WILLIAM EDWARD MCCOMAS, district engineer for the Portland Cement Association, died at his home in Germantown, Pa., on Jan. 17.

WILLIAM S. BLISS, civil engineer, died at his home at Amboy, N. Y., on January 18. He was born in Byron, Wis., in 1855, and was a graduate in civil engineering from the University of Wisconsin.

WALTER ARNSTEIN, well known engineer on the Pacific Coast and president of the old Oakland-Antioch Railroad, was found shot to death in his San Francisco office on Jan. 14. He had recently suffered a nervous breakdown. Mr. Arnstein was 50 years old.

WILLIAM A. GARRIGUES until his recent retirement, president of Levering & Garrigues, structural steel fabricators, died last week at Thomasville, Ga., while on a motor trip through the South. He was in his 76th year and had resided in Plainfield, N. J., for the past 40 years.

MATTHEW TSCHIRGI, who was one of the founders and the first president of the Iowa Engineering Society, died recently at his home in Cedar Rapids, Ia., at the age of 82 years. At one time he was city engineer for Dubuque, Ia., and later was a member of the Cedar Rapids, Ia., city plan commission.

EDWARD CANFIELD, JR., construction engineer, died of a sinus infection on Jan. 16 in a New York hospital. He was 53 years old. Mr. Canfield was graduated from West Point in 1901 and remained in the army service until 1919 when he became construction engineer for the American Cotton Oil Co. He later became president of the B. & A. Co., which specialized in construction work.

EARL N. FLOYD, associate engineer, U. S. Engineer Office, Louisville, Ky., died January 16 from an internal cancer. Mr. Floyd was born near Columbia, Tennessee, February 22, 1881, and was graduated from the University of Tennessee in 1906. His early engineering work was with the Louisville and Nashville Railroad and later with the Nashville office of the U. S. Engineers on some early surveys of Muscle Shoals and on the construction of the Hales Bar Dam.

Engineering Contracts and Capital

BOOSTED BY a $6,000,000 federal court house award in New York, heavy engineering construction contracts reported for the past week reached a total of $17,517,000, a gain of 43 per cent over the previous week's low total of $12,265,000. The weekly average of contracts awarded during the past four weeks is $23,848,000, somewhat more than the January, 1932, average of $23,395,000. Federal awards, which have been averaging less than 3 millions per week, jumped to $9,200,000. State and municipal contracts declined, however, to $4,630,000, from $7,573,000, $16,234,000 and $34,801,000 for the previous three weeks. Highway lettings were the lowest in months, aggregating $2,600,000. Private awards showed a 50-per cent gain over the previous week, amounting to $3,644,000. The total to date this year of all contracts reported is $95,392,000, slightly above the total for the same period last year, $93,581,000. Only two large single contracts were reported during the week. These are the federal court house, New York City, $5,996,000 and a veterans hospital at San Francisco, Calif., $1,183,000.

The list of proposed work is more impressive than it has been for some time. Bids were taken Jan. 24 for the superstructure of the St. John's Park freight terminal for the New York Central R.R. in New York, estimated at $2,500,000. Low bids submitted Jan. 23, for interlocking and signalling equipment for New York subways totaled $2,437,000. Bids will be received in February for four bridges, Richmond, Va., estimated at $2,700,000; for the Cleveland postoffice superstructure, $2,133,000; and for the San Francisco postoffice, estimated at $3,050,000. A million-dollar brewery is planned at Rosslyn, Va. A 3-mile highway tunnel planned near Alameda, Cal., will cost $4,087,000. Permit is sought for creating a water supply for Sacramento, Cal., estimated at $9,000,000.

Few productive capital issues were reported during the week, total sales of bonds amounting to only $1,500,000. These were all public issues, no private issues being reported. No self-liquidating loans were announced by the R.F.C.

Contracts and Capital

CONSTRUCTION

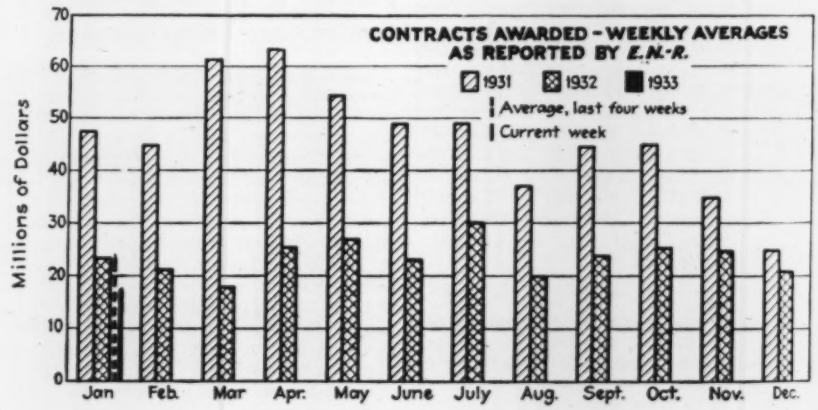
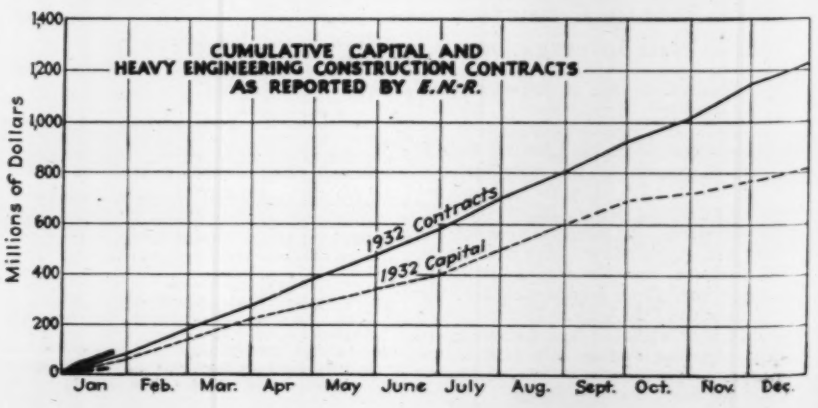
(Thousands of Dollars)

	Weekly Average Jan., 1932	Four Weeks	Week Jan. 26, 1933
Federal government	$4,155	$3,636	$9,243
State and municipal	9,289	15,810	4,630
Total public	$13,444	$19,446	$13,873
Total private	9,951	4,402	3,644
Week's total	$23,395	$23,848	$17,517
Cumulative to date:			
1932			$93,581
1933			95,392

NEW PRODUCTIVE CAPITAL

(Thousands of Dollars)

	Weekly Average Jan., 1932	Four Weeks	Week Jan. 21, 1933
R.F.C. loans made	.....	.....	.....
New capital issues	$25,000	$7,000	$1,600
Total	$25,000	$7,000	$1,600
Cumulative to date:			
1932		$75,000	
1933		24,700	
R.F.C. self-liquidating loans:			
Approved current week			.....
Approved to date (including 1932)			147,651
Actual loans made (including 1932)			17,753

ENR Cost and Volume Index

E.N.-R. Cost		E.N.-R. Volume	
January, 1933	158.44	December, 1932	133
December 1932	158.46	November, 1932	137
January, 1932	162.48	December, 1931	133
1932 (Average)	156.97	1932 (Average)	127
1931 (Average)	181.35	1931 (Average)	220
1930 (Average)	202.35	1930 (Average)	260
1913 Average	100